BUILDINGS: THEIR PLANNING CONSTRUCTION & EQUIPMENT

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MODERN BUILDINGS

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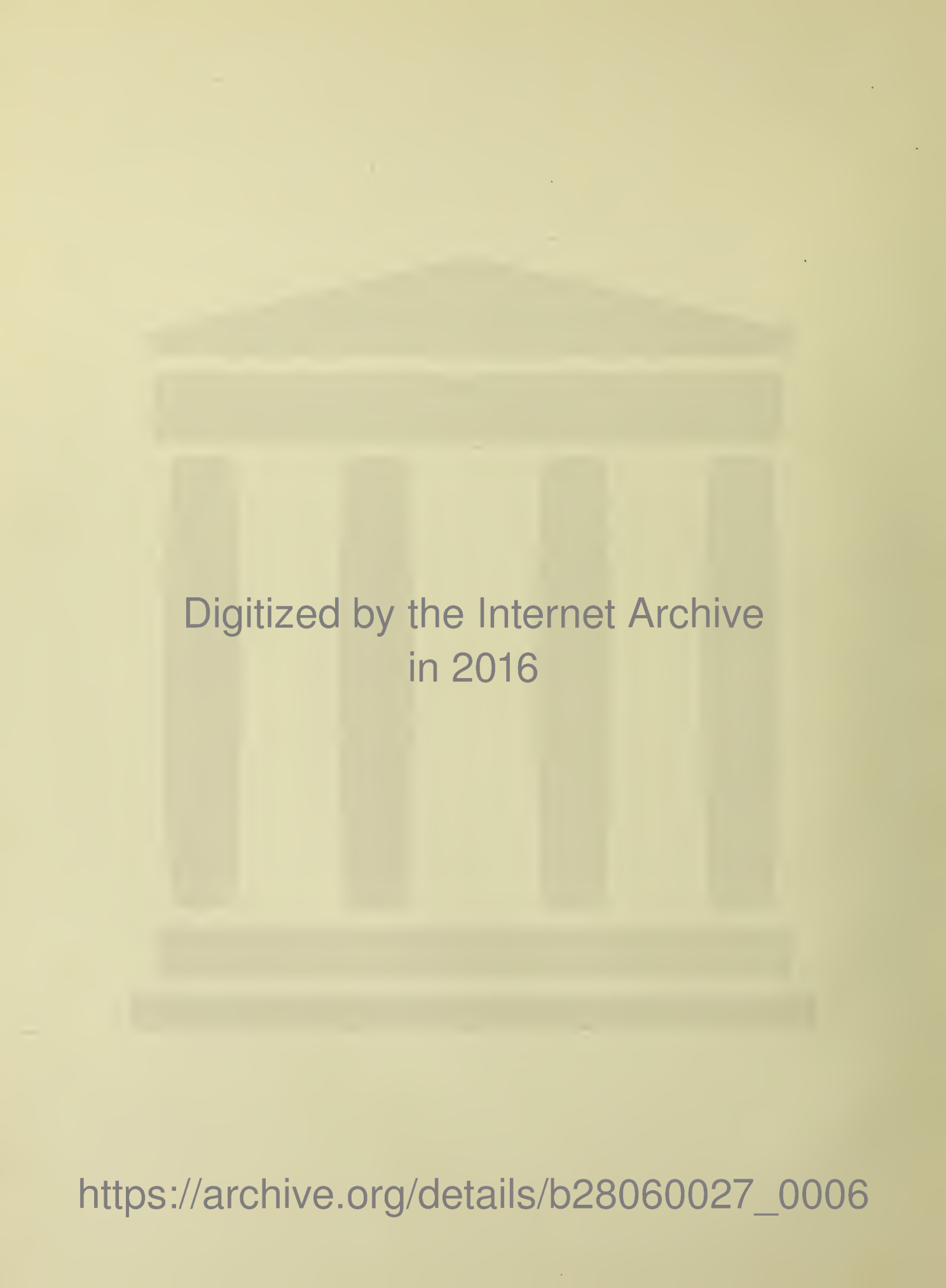

MODERN BUILDINGS

THEIR PLANNING, CONSTRUCTION AND EQUIPMENT

BY

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MODERN BUILDINGS

VOLUME VI

PART I

MISCELLANEOUS BUILDINGS AND THEIR FITTINGS

CHAPTER I

ASSEMBLY HALLS

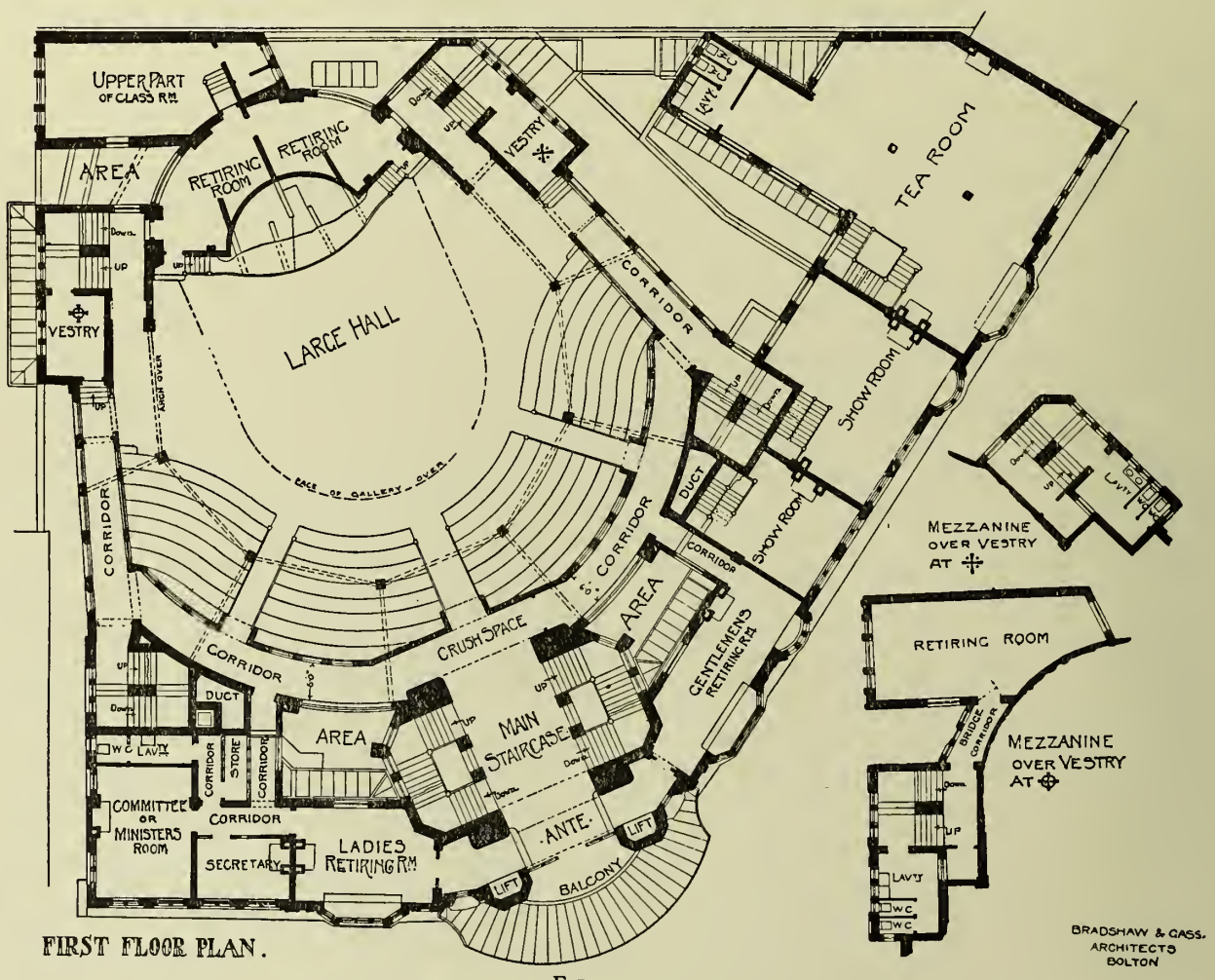
THERE is a large class of Assembly Halls the description of which is almost entirely covered by what has already been said in connection with Town Halls, especially when considering that of Walsall, which was illustrated in Volume IV. Large rectangular buildings, they are generally open on both sides for lighting, while it is preferable that they should be on entirely isolated sites, so as to secure rapid exit in case of panic or fire. The entrance is placed usually at the centre of one of the narrow frontages, through a large crush-room having cloak-rooms on either side, the main doorway to the hall being exactly opposite the street entrance; while it is a maxim in such buildings that all the doorways shall open outwards, being as a general rule fastened only by "panic bolts," which give way immediately on a bar being pushed which lies across the door about 3 feet from the floor. Direct passages, sometimes central only, and sometimes with others on either side, lead from end to end of the hall if the seating be fixed; but in most cases chairs are used, so that they may be cleared away and the whole space devoted to different purposes, as may be required. The far end from the entrance is given up to a platform with retiring-rooms for the performers, behind it or on either side, these being preferably arranged beyond a transverse corridor, so that the performers may meet behind the platform and confer before entering the platform. Special entrances for the performers are almost invariably provided, and, while their retiring-rooms are on the same level as the platform, there is very commonly a space below both for storage or for heating purposes, while this is sometimes utilised for a kitchen or even for a committee-room.

Buildings of this type are common, and range from the small vestry hall or parish-room, which accommodates some 200 persons, up to the large and important town hall or concert hall. Long halls of this character have, however, the disadvantage that they are frequently bad in their acoustic properties, while they add to this defect another in that it is difficult for the persons who sit anywhere near the back of the room to see what is going on because of those in front. It is therefore by no means infrequent for the larger halls to be planned on the horseshoe or theatre system, the great bulk of the audience being situated at approximately the same distance from the platform, and on rising galleries, so that all may see and hear with practically equal distinctness, a corridor at the back of the auditorium forming a kind of sounding board, and resulting in almost perfect acoustics, particularly if the section be such as to lead the voice uniformly all over, and not to waste it in a high roof, or to break it up amongst open timbering.

A fine example of this type is the new Central Hall of the Liverpool Wesleyan Mission, designed by Messrs. Bradshaw & Gass, of which a general view is given in Plate I., showing its architectural treatment and grouping, while a plan of its principal floor, that at the first-floor level, is illustrated in Fig. 1. It occurs on a somewhat restricted site, where two streets meet at an obtuse angle. Following what is the general

custom with large buildings, the main axis is obtained by bisecting this angle, and off this axis the hall is planned. In its principal features it is in agreement with the general scheme of a longitudinal hall, except for the corridor behind the horseshoe arrangement of seats, which branches to right and left of a crush space at the landing of the main staircase. There is a main entrance at the floor level of the hall forming a corridor along the axis, but there are two other radial entrances off the corridor which can be approached either from immediately behind the supporting piers to the gallery above. The hall narrows towards the stage, and is thus of the form which numberless experiments, from the times of the Greek theatre onwards, have shown to be the best for acoustic properties. Behind the platform there are retiring-rooms for performers, which communicate one with another and are reached on either side by special staircases. It is possible to pass direct from them either to the platform or to the hall, and indirectly by means of a few stairs to a class-

LIVERPOOL WESLEYAN MISSION · NEW CENTRAL HALL · RENSHAW STREET



FIRST FLOOR PLAN.

FIG. 1.

the main staircase or from supplementary stairs at the corridor ends — or perhaps, more properly speaking, where the curved corridors join the straight corridors down either side, which lead at their extremities to vestries and to other entrances near the front of the auditorium. The central space of the hall is left open for movable seats, but the horseshoe back is arranged as a series of galleries with radiating passage ways to the entrances just mentioned, so that everyone seated on these galleries can have an unobstructed view of the stage, except such as are seated

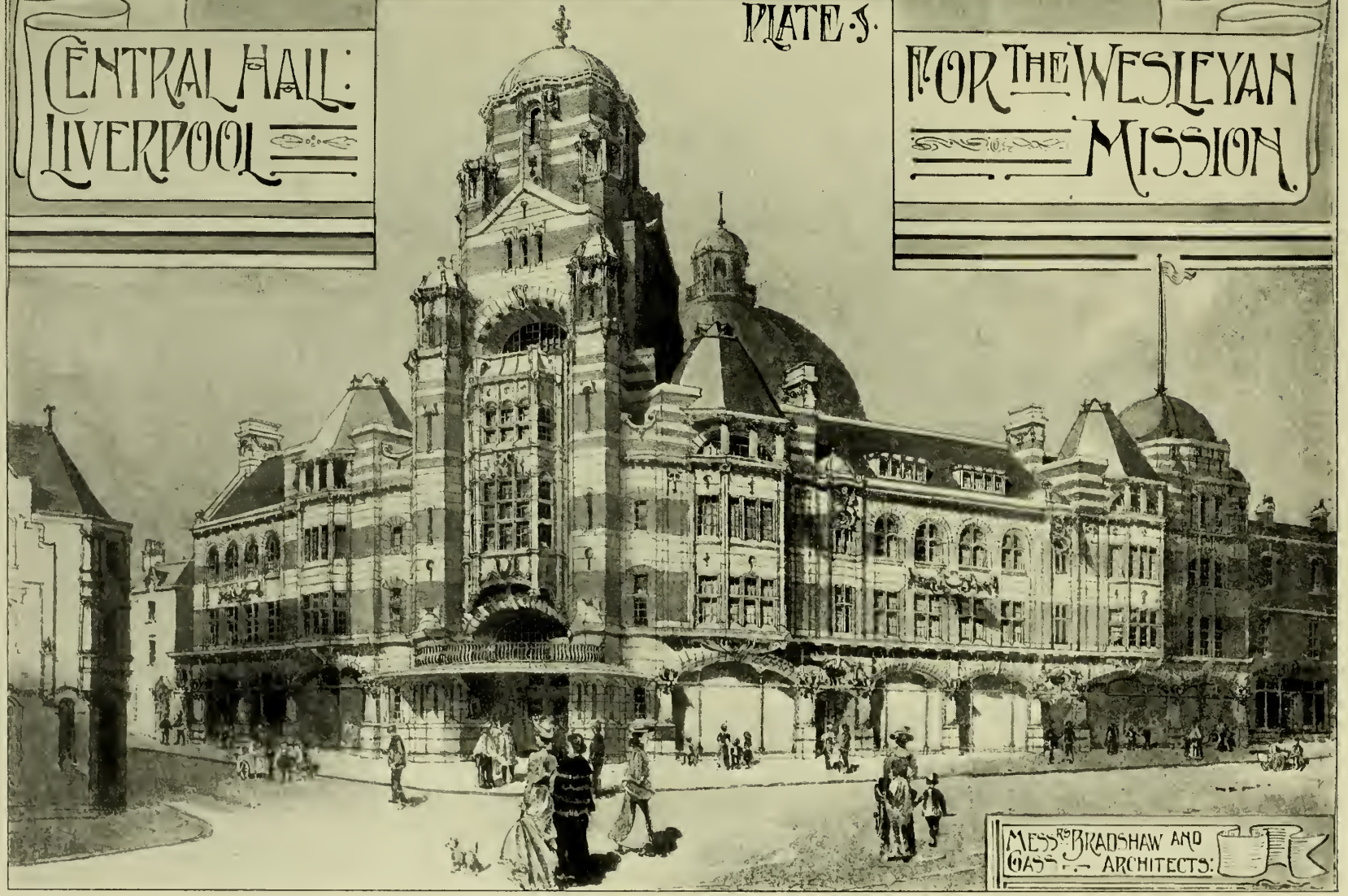
room at the rear, or to vestries and other retiring-rooms —the term "vestry" being obviously used to mean any preparation room for the giving of performances, whether these be lectures, sermons, or concerts. The front of the building, hitherto undescribed, is given up to retiring-rooms approached both from the circular corridor and from the main staircase, and on one side to a small suite of offices for the committee and secretary, and on the other to the upper floors of shops and large tearooms, which it is intended to let off.

The general scheme thus established on the first floor

PLATE I.

CENTRAL HALL: LIVERPOOL

FOR THE WESLEYAN MISSION



MESSRS. BRADSHAW AND GASS — ARCHITECTS.

controls the floors above and below, of which those above more particularly belong to it. On the second floor (see Fig. 2) the arrangement of the main staircase, with the space for the lifts and the retiring-rooms on either side, is exactly the same as below, as also are the offices above the secretary's rooms. The circular corridor at the back of the auditorium is also similarly arranged. Entrances are at such a level that they serve the central row of seats of a large rising gallery auditorium. Necessarily the staircases are continuous from top to bottom of the building, and the stairs are in short flights without winders, so as to afford the readiest possible means of exit in case of panic.

The shape of the platform, with its front projecting out into the hall and the raised organ at the back, is admirable for the rendering of chorus music.

The third-floor plan (Fig. 3) is little more than a continuation of that of the second floor, except that the

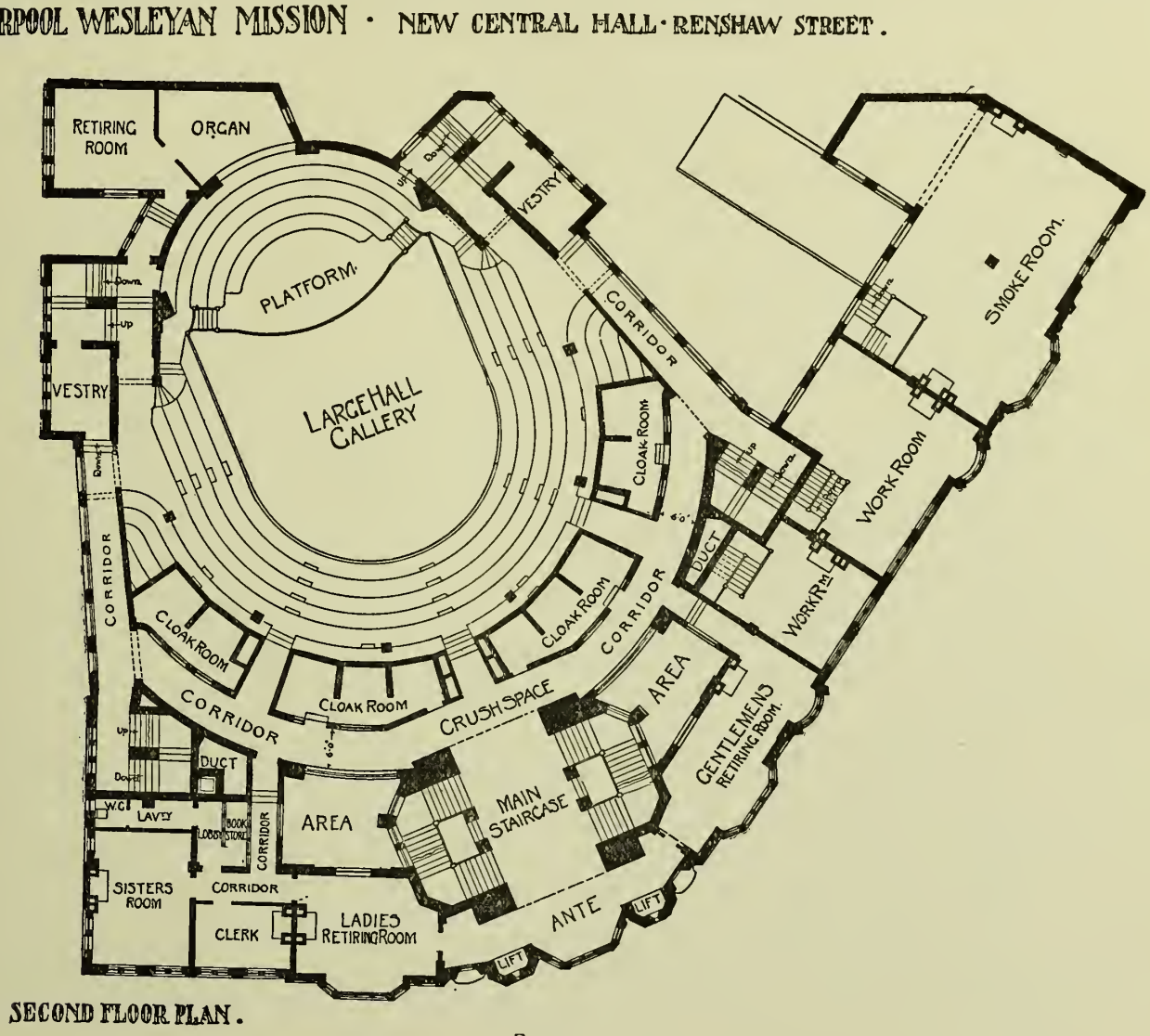


FIG. 2.

of horseshoe form, the space beneath the upper rows being utilised for cloak-rooms. The platform is also arranged with rising seats, having the upper rows just above the level of the bottom rows of the gallery; and the way by which this platform can be served, either from the floor of the hall as shown in Fig. 1 or from the gallery as shown in Fig. 2, and equally well from all the so-called vestries or retiring-rooms, is exceedingly clear, it being possible for persons to obtain easy access to the platform from all parts of the circular corridor has had to give way to further seats in the gallery and a passage behind them, while the rooms in the front are now devoted to two series of recreation-rooms and to a small caretaker's house. The smaller set of recreation-rooms can be served either by the main staircase and its adjoining lifts, or by the small staircase on the left-hand side; while a much larger series is served by the staircase on the right-hand side, there being no means of communication between the one series and the other except through

the caretaker's apartments, the kitchen of which directly opens into the larger recreation-room. This, the top floor, is evidently to some extent a makeshift plan, as very frequently happens in public buildings, and the caretaker comes off badly in consequence. He is only given two bedrooms, and these are quite small and open out of one another, an arrangement which renders it impossible for a man with a family to be put in charge of the building.

noticed, is repeated throughout the whole of the building, as shown in Figs. 1, 2, and 3. Opposite the main outer doors there are swing doors opening into a large reception-room lighted from areas on either side of the staircase; and beyond this reception-hall, again separated from it by movable screens, is what is called the "small hall," which is, however, large enough for a numerous audience, or could be utilised in conjunction with the reception-hall for many other

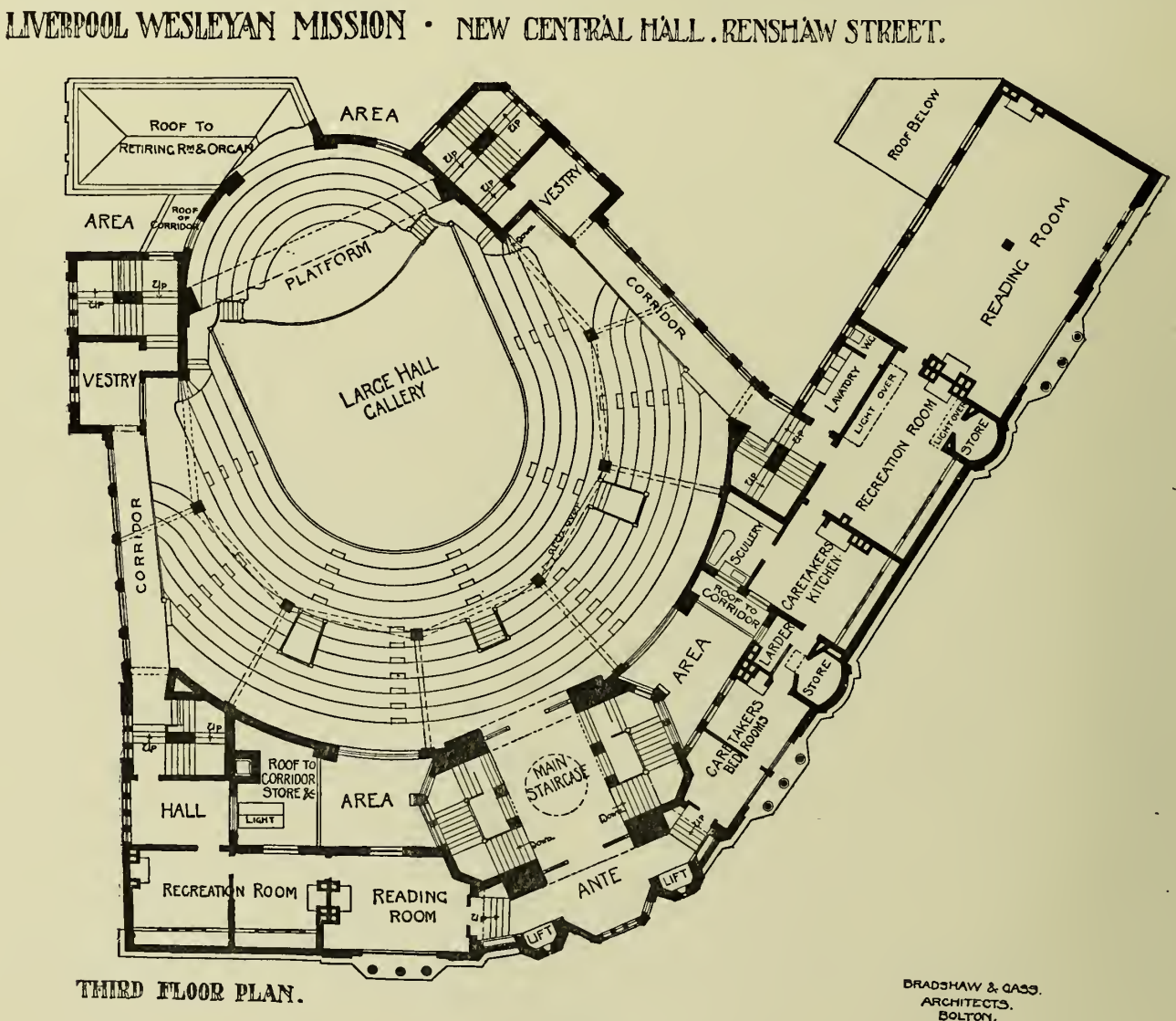


FIG. 3.

Passing downwards, Fig. 4 illustrates the ground floor, and two small mezzanines which lie between the ground floor and first-floor levels at the back. It is on this floor where the arrangement at the entrance is most clearly seen, with its wide open space outside the main doors from which two porter's offices open on right and left, and beyond it a handsome hall, out of which on either side winds a large staircase planned so as not to obstruct the central passage way in the very slightest degree,—an arrangement which, it will have been

purposes, such as bazaars — though the means by which it is lighted other than artificially are not particularly obvious, owing to its being covered by the larger hall on the upper floor. It is seated with a rising gallery at the back, of segmental form, opposite to a platform of some considerable size, this arrangement being somewhat obscured on the plan, as illustrated, by the arrangement of the girders to carry the floor above being shown in dotted lines.

On the left-hand side of the site a passage way will

be noticed which serves the subsidiary staircase on that side, and a similar passage way occurs in Renshaw Street, between shops Nos. 6 and 7. The whole of the Fleet Street frontage, except that occupied by the main entrance and the two passages just mentioned, is given up to shops, which, as they face important thoroughfares, could be let at considerable rentals. Of these, Nos. 1, 2, 3, and 4 are of one storey only; No. 8 has a basement for storage purposes, as shown in Fig. 5; and is tapped, and, as will be seen by the general view in Plate I., the general effect is not destroyed thereby.

The basement plan (Fig. 5), besides containing the cellarage accommodation to the shops, as just mentioned, has a reading-room and smoking-room, with a coffee bar for those attending the various functions in the hall, reached by carrying down the main staircase, while there is a large drill hall underneath the reception hall of the ground floor. Behind this the space under the

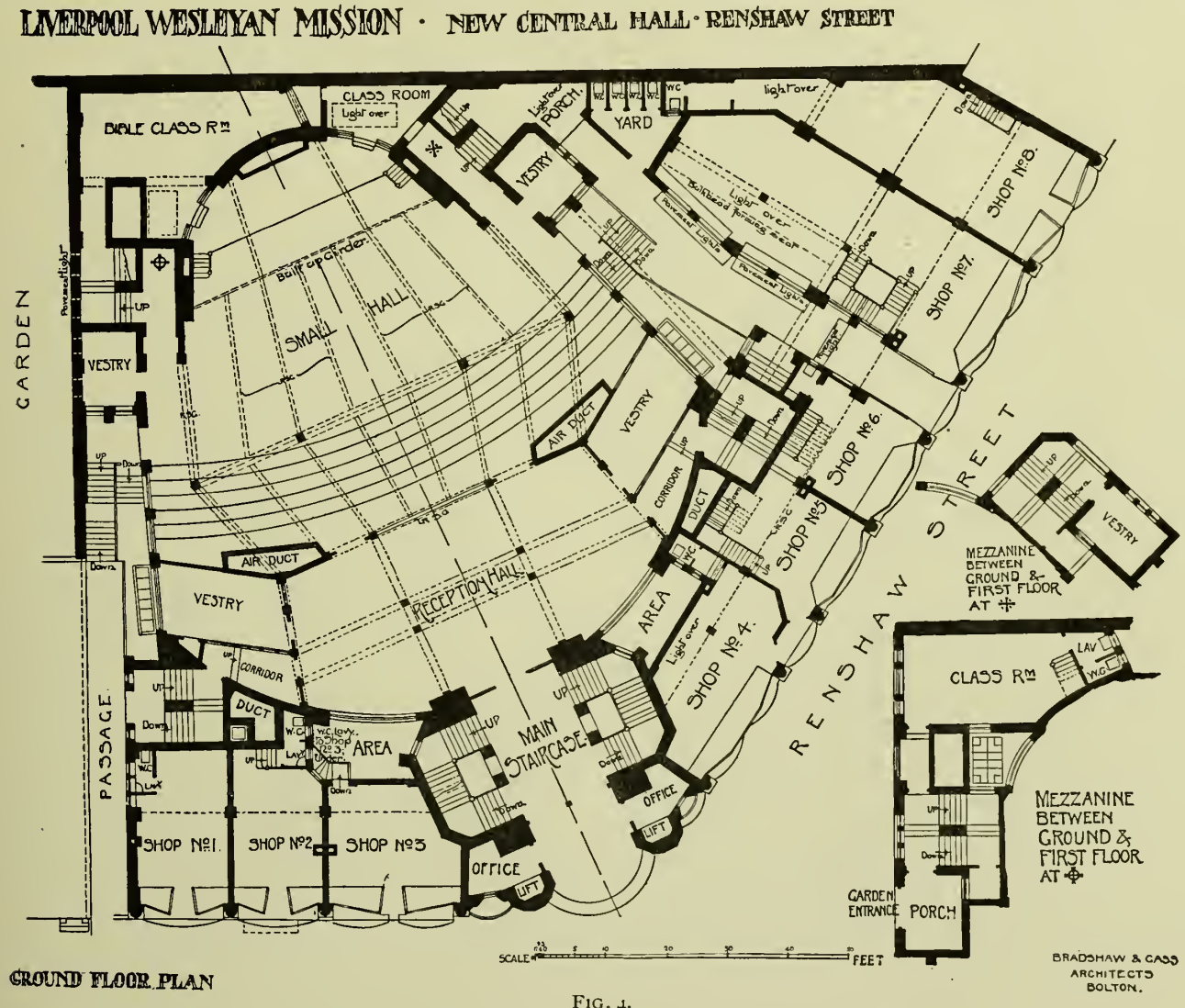


FIG. 4.

Nos. 5 and 6 have basements and also possess showrooms on the first floor and workrooms on the second; while No. 7, which is by far the largest, has a basement under its whole area, and on the first floor has a tea-room, and on the second floor a smoking-room, these being carried over shop No. 8 as well, forming a large confectioner's or refreshment establishment. By this arrangement of shops an enormous source of income

small hall is devoted almost exclusively, so far as it is occupied, to the ventilating apparatus and its ducts, which, it will be seen, on reference to the other plans illustrated in Figs. 1 to 4, are carried up throughout the whole of the building, though the points of discharge could not be indicated without giving a section. The heating apparatus, however, is distinct, it being located under shops 1 and 2.

LIVERPOOL WESLEYAN MISSION · NEW CENTRAL HALL · RENSHAW STREET

FIG. 5.

CHAPTER II

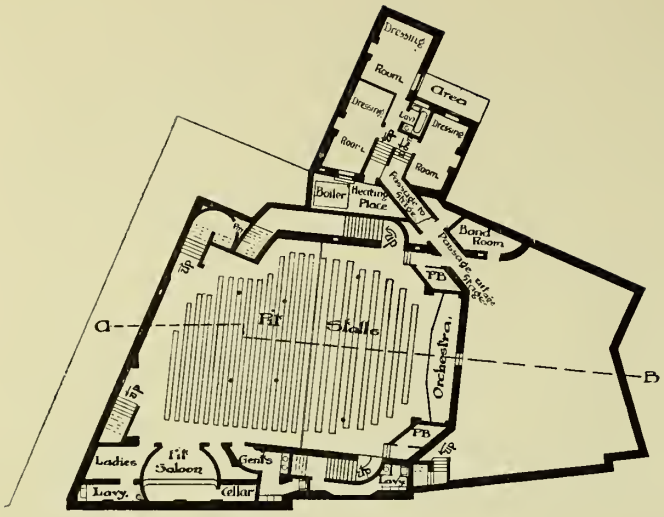
THEATRES

THEATRES are perhaps the most difficult of all buildings that an architect is ever called upon to plan. A considerable knowledge of stage craft is above all things necessary, for there is not only the auditorium to arrange, so that everyone shall be able to see and to hear, and with entrances and exits so contrived that there shall be no crushing, and that the theatre may be emptied in case of emergency with extreme rapidity; but there is behind the scenes a large and practically a separate building, which must have a large space devoted to scenery and the necessary machinery for shifting it, together with dressing-rooms for numerous performers.

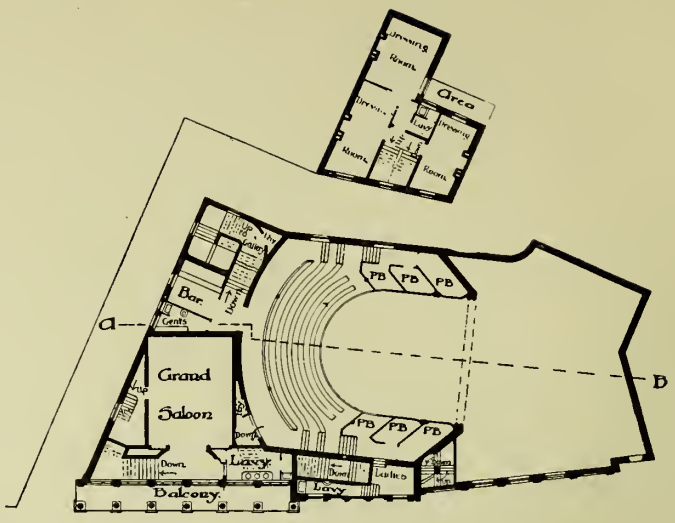
It is now considered essential that a theatre should be detached from all other buildings, at least on three of its sides, while it is much better if it is entirely isolated; as the risk of fire is considerable, and has to be guarded against not only within the building itself but outside also, in order that, if a fire arises, it shall not be communicated farther; while isolation also permits of the fire engines and escape ladders being brought to all parts. The risks of fire and of panic have proved to be of so serious a nature that everything possible is done to minimise them, the modern theatre being constructed almost entirely of fire-resisting materials, such as brickwork, steel, and concrete, even the hangings and upholstery being saturated with a substance which renders them non-flammable. It is also customary to separate the stage from the auditorium by a fire-proof curtain, down which a stream of water can be made to pour by merely opening a tap, so that if a fire originates in either of the great sections of the building it should not be communicated to the other, there being no direct means by which the one can be reached from the other, except perhaps below the stage level. Water sprinklers, to which attention has been called in an earlier volume of this book, are usually fitted in several parts of the building, particularly in what are known as the "flies" and on the "grill" above the stage; for it is always necessary to carry up this part of the building to a great height for the accommodation of lifting scenes. Artificial lighting has also to be considered in the planning, though as a rule this is now done by electricity and is a comparatively easy matter to arrange. Still, there should always be two sources of light, so that in the event of an accident happening to the electric wires the house may not be left in utter darkness, but an alternative method of lighting, such as that by means of gas, should be immediately available. In many theatres oil lamps are also kept in store, but these must be of the colza oil pattern, burning heavy oils, the highly inflammable mineral oils being inadmissible. The greatest danger of fire exists in the use of naked gas lights, in order to produce special effects upon the stage, in close proximity to flimsy curtains and oil-painted canvas, the head-lights and foot-lights which are in view of the audience causing comparatively little danger. It is now usual for all these to be electric, but additional gas burners are generally provided along the front of the stage, or proscenium opening, as it is called, both at top and bottom, and occasionally standards of gas burners are still to be found in the wings, though careful managers avoid them.

Possibly an understanding of the general principles of theatre planning will be best obtained by considering one well-designed example, and that of the Garrick Theatre, planned by Mr. Walter Emden, has been selected, as, although small, it illustrates all the principal points (see Fig. 6). It is placed on an awkwardly shaped piece of land, but is so contrived as to be almost entirely isolated, the only portion which adjoins other buildings being at the back of the stage, where it is cut off from all else by a thick brick wall. The dressing-rooms occur in a detached building, which communicates with the main building only by a subway, this rare arrangement being rendered possible by the peculiar shape of the land, whose awkwardness was thus very cleverly brought into use. Thus in this case the theatre consists of three distinct buildings,—the auditorium, the stage, and the dressing-rooms, which may very well be considered separately.

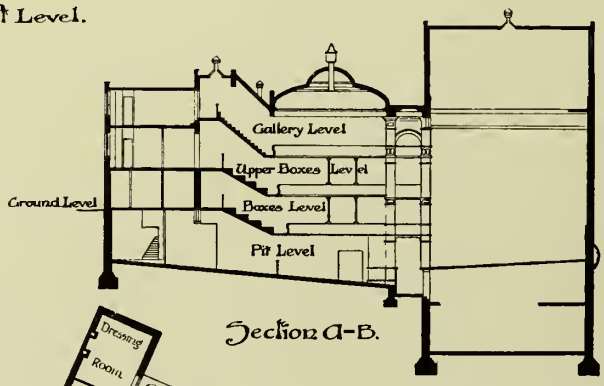
The principal floor is that at the boxes level, the plan being followed, which is now very common, of sinking the pit, the stage, and its cellar in a huge excavation below the ground, it having been found that by this means exit is rendered more rapid, while the introduction of scenery from without is made easy, and in case of panic or fire access can readily be obtained to all the parts. It will be noticed, on reference to the plan, that the theatre is arranged longitudinally along a straight frontage to Charing Cross Road, from which there are several entrances. The main entrance serves through the grand vestibule to the stalls by means of staircases which pass downwards, and to the boxes at the level of the back row; while, although there is a separate door for the upper boxes, the staircase leading to them also communicates



Plan at Pit Level.



Plan at Upper Boxes Level.

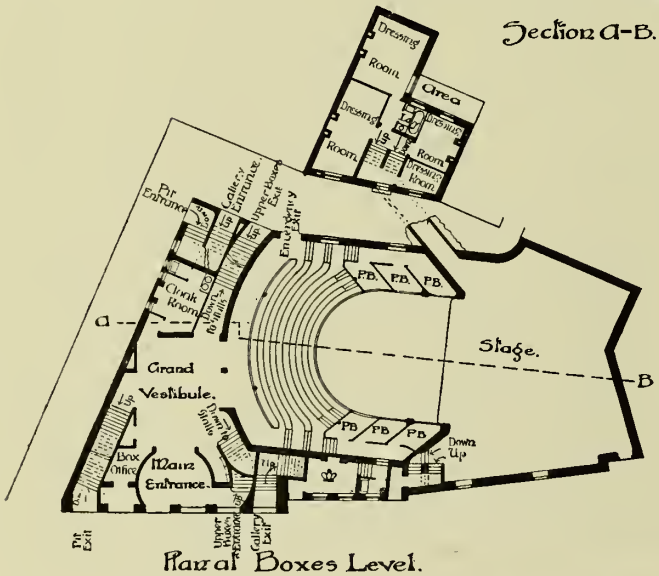


Section A-B.

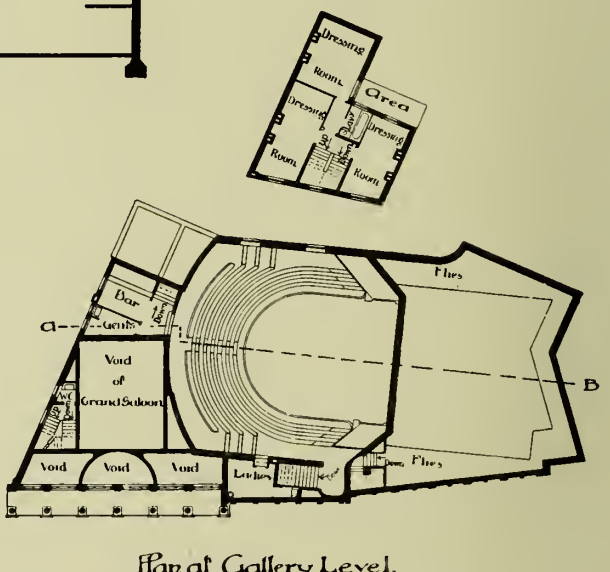
The Garrick Theatre Charing Cross Road. W.C.

Walter Emden. Architect.

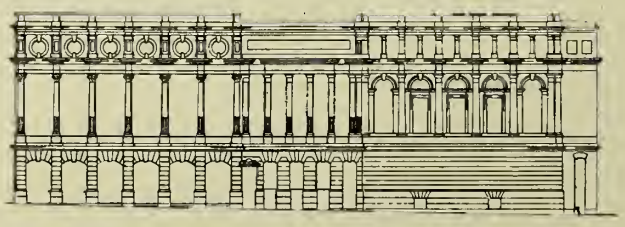
Scale of feet



Plan at Boxes Level.



Plan at Gallery Level.



Elevation to Charing Cross Road.

FIG. 6.

with the main entrance, so that the same box office serves for the boxes and stalls. The stairs require a good deal of careful investigation, as they are planned so as to overlie one another, this being a common feature in theatre work; for it is essential that each part of the house may be reached independently, and shall have exits quite separate from one another, and from all else, leading to two different streets or sides of the building at least. Thus the boxes are reached, as has just been said, through the main entrance and the grand vestibule, but they have an emergency exit on the same level to the back lane. The stalls have two stairways down to them from the vestibule, and as this is large there is no necessity for giving a further emergency exit, though it could be obtained by climbing over the barrier between the stalls and the pit, shown on the plan at pit level. The upper boxes are reached from the main entrance, up quite a short flight of stairs which passes up beneath the lavatory shown on the front of the plan at the upper boxes level, while an emergency exit is found at the back beside the bar, for which, like the other stairs, a single straight flight suffices. There is an entrance for royalty, marked with a crown, in the middle of the principal frontage, yet set back so as to secure a certain amount of privacy. A private room is reached through a porch, whence the private boxes can be reached at the boxes level by passing down a few stairs; for it may be noticed that when we speak of the boxes level we do not necessarily mean a horizontal plane, as the seats on each of the "levels" are necessarily arranged in tiers, so that the persons seated in the back rows may see over the heads of those in front. In case of emergency royalty can escape through their private room or else by any of the other means of escape from the boxes.

The entrances to the pit and gallery are both obtained in a back lane, a very excellent arrangement, as all "lining-up" in advance of the opening of the theatre doors occurs in a long lane or passage-way which is private to the theatre, and so causes no obstruction to the general traffic along the street. The doors are not side by side, and so separate queues can be formed to each. The stairs to the pit lead downwards and wind considerably, but like all others they are in straight flights of not less than three nor more than thirteen steps, in accordance with the London regulations. An emergency exit from the pit is brought up to the front close to the entrance to the box office. The gallery entrance in the back lane is up stairs which wind above those going down to the pit, and it is of some interest to trace them along the various plans, showing how eventually they reach the back of the gallery almost in the centre at the very top of the house, while an emergency exit is contrived at the stage end of the auditorium near the front, by stairs which pass down above the royal private room.

The auditorium is seated on a slightly rising floor at the pit level, with straight rows of seats, but on all the other levels the seats are arranged in horseshoe form, with private boxes on the straight portions of the horseshoe which are nearest the stage. The seating thus permits everybody to see and hear, and a glance at the section will show how the various tiers rise at different angles in order that this may be accomplished, the object being to give everyone a sight of the front of the stage as well as of the back, and if possible of the whole of it from side to side. At the pit level the whole is one open space, with the exception of a saloon or bar contrived under the main entrance, and of the necessary retiring-rooms. On the other floors the auditorium proper is cut off from the stairs and other adjuncts by means of a segmental wall parallel to the last row of seats on the horseshoe, and separated from it by a passage-way. At the boxes level the space behind this wall is given up to cloak-rooms and the grand vestibule, out of which there rises a staircase leading to a large room, known as the "grand saloon," which occurs at the upper boxes level, forming a handsome apartment in which suppers can be given if necessary. At that level also there is a small bar to serve the upper boxes, while an almost similar arrangement occurs at the gallery level.

Of course, there is a great deal of steel work in the construction, as all the upper tiers of seats are carried on girders and columns.

Although, on the plan at the boxes level, the stage appears to be open to the auditorium, it is actually separated off by what is known as the proscenium opening, and the stage is a distinct part of the theatre. On the plans of the upper boxes and gallery levels the stage is shown as a large open space with flies, or, in other words, balconies, round at the higher level above the proscenium opening as shown on the section, there being also at that level what is known as the "gridiron" covering the whole space for the management of scenery. Below the stage itself are two basement levels, mostly for storage and scenery purposes, and for the working of trap doors; while, as shown on the plan at the pit level, an entrance is thus managed for the band to the space for the orchestra in front of the stage, it being possible for them to reach it either from the dressing-rooms or from the stalls.

There are two entrances to the stage from Charing Cross Road, one of them leading by means of a staircase into the flies, while the other opens direct from the street into the basement at the back of the stage, and is intended for the introduction of scenery. It is designed as a tall narrow opening for this purpose, as will be seen by reference to the elevation. From the stage there is a slope downwards on the north side, which passes under the back lane to a basement series of dressing-rooms. These dressing-rooms are arranged as an entirely separate house, and are as complete as those in any theatre in London, there being three distinct rooms on each floor, together with lavatories and even a bathroom. These are all externally lighted, but

naturally are used more at night-time than during the day.

By way of summary, it may be pointed out again that the principal points to aim at are complete department-ation, so that the dressing-rooms, the stage, and the auditorium are practically distinct, capable of being perfectly separated in case of fire, while separate exits, ample in number, are provided from every part; and even from the stage it will be seen that there are exits to the right, in front, and to the dressing-room annexe in the rear. The staircases need extreme care in planning, and all corners in them should be rounded. In the auditorium it is necessary that every seat should have a full view of the stage, and the slopes both of the floor and the stage itself, and of the various galleries, have to be arranged with this object. Lighting and ventilation have also to be carefully attended to, but acoustic properties are almost sure to be good if the horseshoe plan is adopted with a passage-way behind the auditorium, and the seats in galleries rising one above another, and if there be ample ventilation.

CHAPTER III

PROTECTION AGAINST FIRE IN PLACES OF ENTERTAINMENT

(*Contributed by P. R. Strong*)

The risk of fire in a theatre is the risk to the lives often of many hundreds of people. The materials used upon the stage, the flimsy hangings and decorations, unless special means be taken to prevent it, may be readily set alight, while the large open area of the theatre is particularly conducive to a fierce fire. To indicate the great risk of fire in such places it may be mentioned that Mr. E. O. Sachs, in his work on *Modern Opera Houses and Theatres*, enumerates eleven hundred cases of fire in theatres, music halls, etc., while the awful danger of life attendant upon such outbreaks is common knowledge.

Exits.—The lives of so many being at stake, it is obviously the first duty of all responsible to provide and maintain ample and suitable exits for the immediate escape of the people. These exits should, in fact, be sufficient to allow the whole audience, no matter of what size, to leave the theatre in two minutes; for the spread of fire and smoke to all parts of the theatre may be almost instantaneous. But it is not only in the event of fire that ample and easy exits are necessary, for they will be almost equally important in the event of an alarm of fire. A most trivial occurrence will often cause a panic resulting in many deaths; in fact, the majority of fatalities in theatre fires may be attributed to panic. A rush will be made for the exit, some one will stumble over an unseen step, others will fall over the first, and the stream of panic-stricken people will attempt to climb over those fallen, in their mad efforts to reach safety. The consequence of such an occurrence will be that few will reach the outer air before they are overcome by the poisonous fumes of combustion, while if the alarm has been false many will have been crushed to death in the rush and jamb.

It is, then, not only necessary to provide ample exits, but these exits must be as direct and as easy as possible. Careful planning will not only allow the house to be emptied rapidly, but the sense of security thus obtained will go far to prevent panic.

Every division of the house, stalls, pit, dress circle, etc., not omitting orchestra and stage, must each have at least two exits, one of which may also be an entrance. These exits in each part of the house should be as far away from the stage as possible, for it is on the stage that a theatre fire will nearly always originate, and the natural impulse of the people will be to flee in a direction away from the fire. The exits should also be one on either side of the house for each part, and should communicate immediately with the street.

Site of Theatre.—In order to realise the latter requirement it is necessary that both sides of the theatre as well as the front shall abut on streets or other thoroughfares, while in order to provide against the external fire risk the fourth side also may well be bounded by a street. A site such as is thus called for will seldom be procurable, and the condition must be attained by giving up part of the building site for the reformation of these thoroughfares. Very few theatres in London realise these conditions, although some of the provincial towns are leading the way in this direction.

It is further of importance that theatres shall not be set down among buildings of the warehouse class, or any buildings having extremely inflammable contents.

Staircases.—Those parts of the house that are on a level with the ground may have exits leading at once into the street, but others must make use of staircases. It is important that no part of the house shall be at any great height above the pavement Probably the best arrangement will be obtained if the lowest parts of the house are at least as far below street level as the top tier is above it. To go upstairs to the streets is considerably more desirable, in case of panic, than to descend. The press of people in descending a staircase is very liable to cause someone to stumble, and the consequent crushing will ensue.

In order to avoid the danger just mentioned, exit stairs must be as easy in the going as possible, with risers not more than 6 inches high; while winding steps must not be allowed. The stairs should be enclosed with walls, and should in no case be of open construction; they should have hand-rails on either side, while if they are 6 feet or more in width they should be divided in two by a central hand-rail. These hand-rails are of great assistance in preventing persons from stumbling. All unexpected steps are strictly to be avoided, while, on passing through a door, a landing should be met before the staircase begins. There should be no doors leading into the stairs other than that from the auditorium at the top or bottom, and that into the open air at street level. The stairs should be of solid description, and at least sufficiently fire resist-

ing to remain unaffected until every one can be got out of the building. The width of a staircase must naturally be governed by the number of people it has to serve. The London County Council's regulations lay down that, to accommodate not more than 300 people, staircases shall be at least 4 feet wide, while if more than 300 people are to use the staircase it must be 5 feet wide.

Notices and Illumination.—Having provided ample and direct exits, it is then necessary that their whereabouts and the exact route to be taken in leaving the theatre should be clear and thoroughly indicated by large and well-lighted notices. The lights used for this purpose should form a system entirely distinct from that of the remainder of the theatre, in order to render them less liable to failure in case of fire. It is sometimes required that the exit notices should be illuminated with oil lamps, as these are independent of any one general source of supply. However, if either gas or oil be used for this purpose, the flame should be entirely shut off from the air in the auditorium, and the air supply should come from without by the use of inlet and exhaust pipes, otherwise the draught and smoke produced by a fire may in all probability render them useless.

All doors, not being exit doors, which are not labelled "Refreshment Room," "Cloak Room," etc. must be labelled "No Exit," in order that people may have no hesitation as to the route they are to take.

Separate systems of lights should exist for the stage, for the auditorium, and for the exits and passages, while there should be two complete installations throughout the whole theatre, in order that the theatre may not be left in darkness, which might possibly cause panic. The two installations may consist of electricity and gas, gas and oil, electricity and oil, or electricity supplied by two separate companies. Electricity (incandescent), properly installed, is infinitely the preferable form of lighting, on account of the absence of a naked flame, as well as from the fact that it is unaffected by draught and smoke.

Doors.—All doors must open in the direction in which people pass on leaving the theatre,—that is to say, they must open outwards; and in order that they shall not in any way form an obstruction, they should open right back as far as the wall behind them.

There is another and most important necessity in reference to all doors in connection with exits, and one which needs strict attention, for it must largely depend upon the management of the theatre, namely, all such doors must never be locked or bolted at any time while an audience is in the theatre, except by means of automatic bolts which may be withdrawn by simple pressure against a bar on the inside of the door.

Lastly, in order that the audience may be acquainted with the routes to be taken, and in order to ensure the readiness of all exit doors to be opened, the audience on conclusion of the performance must be permitted to leave the theatre by every exit, while there should be no such thing as an "Emergency Exit."

Gangways and Passages.—Not only must the actual exits and exit passages and staircases be considered in respect to rapid flight; but every part of the theatre that must be traversed in order to leave it must be arranged on the same principles. The distance between seats must be such that people can pass readily, and the automatic tipping seat is of great service in this respect. On leaving the seats the gangways must be of ample proportions and should, if possible, be constructed with slopes instead of steps; for the latter, as before pointed out, may lead to much confusion and loss of life. In order that people may quickly reach these gangways from their seats, the number of seats in a single row between gangways should be limited, and in this respect the London County Council's regulations specify that "no seat shall be more than 10 feet from a gangway measured in a line of the seating."

No temporary obstruction must be allowed in any passage or staircase. If a chair or other article of furniture be used in any part which the audience have to traverse on their way out, it should be fixed to the floor, for the danger of any such article loose among a panic-stricken crowd is obvious. In certain cases, as those in which halls are only occasionally used for the purpose of performances, it is difficult to attain the latter requirement; but in any case, rows of chairs must be rigidly battened together.

Proscenium Wall.—Hitherto only the rapid exit of the people has been considered; but even the best arrangements in this respect may be insufficient if other principles are neglected. As before stated, nearly every fire originates upon the stage, and it is therefore essential that every effort should be taken to enable the stage to be immediately cut off from the auditorium in case of fire. The wall separating the two parts of the house should have no other opening in it than the proscenium opening, while communication between the two should be made through the external air. If, however, the latter cannot be effected, the necessary openings must be thoroughly protected with fire-resisting doors.

The proper protection of the proscenium opening is of the greatest difficulty, but may be effected when thoroughly considered with the questions of air currents. Rolling blinds of asbestos have shown themselves to be useless for the purpose. The construction of the screen, whether of asbestos or iron, must be thoroughly rigid and well stiffened, while, to make room for it when raised, the height of the roof above the proscenium opening must not be less than the height of the opening.

Air Currents.—Apart from panic, the primary cause of nearly every fatality from fire may be put down to the subject being overcome by the fumes of combustion, and as these fumes may spread with great rapidity to all parts of the house it is particularly important that they, as well as the actual flames, should be confined

and led away from those parts of the house which are filled with people.

Fig. 7 shows a possible section of a theatre in which the question of air current has not been considered. The auditorium is ventilated with a central "Sun-burner," and every tier is ventilated by exhaust ventilators at the back, while the opening immediately above the stage is practically nil. The direction that would be taken by fumes and flames in case of fire is indicated by arrows. It is probable that plenty of air can enter at the back and sides of the stage, and the fire thus fanned, in burning the inflammable scenery, will produce dense volumes of smoke, which, if the proscenium opening be not properly protected, will immediately enter the auditorium and pass to the exhaust openings, as indicated by the arrows. The effect of this would be most serious in the gallery, where, as has been known to happen, the people may not even have time to leave their seats before being overcome by the fumes. In respect to the gallery, a great danger may be noticed in the form of section given, in that the ceiling over it forms the highest part of the auditorium, and smoke will consequently collect there at once. Having filled

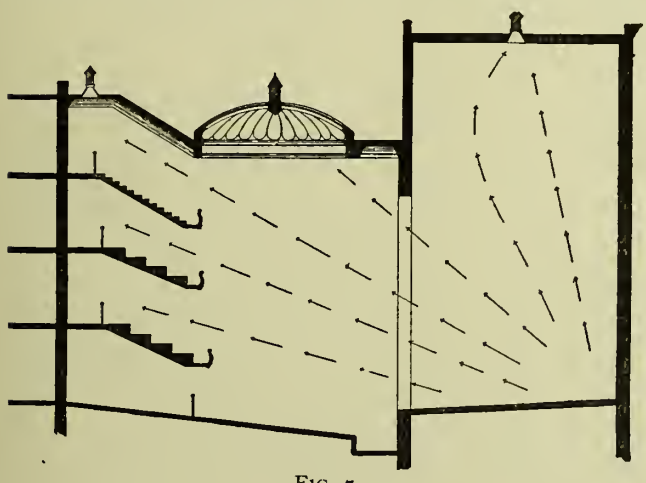


Fig. 7.

the upper parts of the house with smoke, or before this if the air currents be suitable, the fumes will enter the passages and staircases, suffocating those who are struggling to escape.

Fig. 8 is intended to illustrate the direction in which a remedy from the above dangers may be sought. First and foremost may be placed the fire-resisting screen or "curtain" to divide the dangerous source of fire, the stage, from the auditorium. But the screen at the last moment may possibly become inoperative, or if this should not occur air currents which may have received little attention may go far to overcome the protection afforded by the screen.

Assuming that a fire is started upon the stage, and that the fire screen is satisfactorily lowered. The stage will become loaded with smoke, and many of those employed upon the stage, who often amount to hundreds, will in all probability be overcome by it; while, from the same cause, the fire-brigade will be unable to enter in order to extinguish the fire.

It is necessary, then, to supply an opening in the roof above the stage of ample proportions to allow the smoke to pass away. This is illustrated in Fig. 8. The London County Council's regulations in regard to this specify that the roof over the stage shall be provided with an opening at the back thereof equal at the base to $\frac{1}{10}$ the area of the stage, the opening being glazed with thin glass and automatically opened in case of fire, or simultaneously opened on lowering the fire-resisting screen. With the provision of the screen and the large ventilator over the stage the fumes will readily escape, and will have no great tendency to force a passage into the auditorium, while the stage will be sufficiently clear of smoke to allow firemen to enter.

With the question of air currents properly considered, an audience may have time to escape even if the fire-

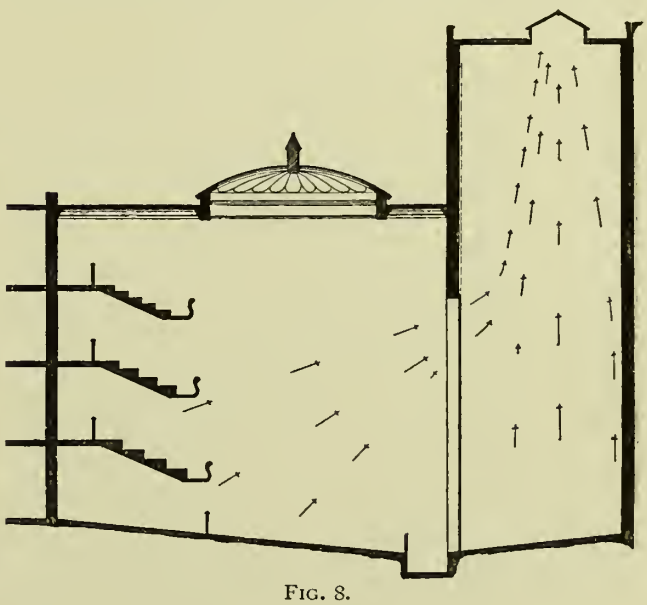


Fig. 8.

resisting screen refuses to fall. In order that the fumes may be prevented from passing into the auditorium, air currents must be arranged to pass if possible from the auditorium towards the stage. For this purpose the large ventilator provided in the roof over the stage must be open, while those ventilators in the auditorium must be closed. These two actions should be controllable simultaneously from the stage and house. The arrows in Fig. 8 indicate the direction of the air currents in this case.

In order that the people in the gallery may not be overcome by the collection of fumes, this part of the house should not be higher than the rest of the auditorium, while no seat should be above the level of the proscenium opening.

Prevention of Fire.—Having provided for the rapid exit of the people from a theatre, and for their protection against the danger of being overcome by fumes, it is of

further importance that material to produce a fire shall be reduced as far as possible. All woodwork, hangings, decorations, scenes, and stuffs of all descriptions, including flimsy dresses, should be rendered non-inflammable by chemical treatment, and maintained in this condition. Air space behind woodwork must be carefully avoided. The use of woodwork upon the stage should be avoided as far as possible; it is, of course, necessary for the actual flooring of the stage, but it may be made of hard wood carefully jointed and of moderate thickness. Wire ropes wherever possible should be substituted for hempen ones, as the latter may readily lead to the spread of fire.

All stores, scene stores, shops, etc., where fires are very liable to originate, and particularly the heating apparatus, should, if possible, be completely isolated from the theatre. If this is not possible they must be divided from it by thoroughly fire-resisting walls; while if openings be made in these they should be covered with double fire-resisting doors.

Construction.—All that has been said hitherto concerning theatres refers chiefly to their planning and general arrangement as far as they affect life. The actual construction has not yet been discussed. As far as it affects the safety of the people, the construction need only be such that it will successfully resist fire for a period sufficiently long to enable the people to make their escape. Wood is not entirely objectionable as long as it is used in heavy pieces with close joints, and an absence of sharp corners and exposed edges, on what is known as the "Slow burning principle." Solid wood stairs are probably less liable to cause slipping than are those of stone, while firemen often prefer them to those of incombustible construction, as they will support a load until they are almost burnt through, while those of stone may suddenly give way without warning.

As far as the protection of property is concerned, the principles discussed in Volume IV. with reference to other buildings apply equally here, while especial care should be taken to see that the effort to gain all possible space and uninterrupted view is not carried to the extent of leaving the metal work insufficiently protected.

Improper Use of Buildings.—A great source of danger exists in the use of buildings for purposes other than those for which they were originally designed. A hall intended to be used for dances does not require such extensive provision of exits as it does if it is to be used for theatrical entertainments, while if the latter are likely to be held in the hall provision should be made in designing the building.

A very common case of this improper employment of buildings is the periodical use of schoolrooms for the holding of amateur theatricals and other entertainments, for which the room is packed with people who, in all probability, must make their exit through a single small doorway; while, to make matters worse, old and flimsy scenery is employed, lighted by oil lamps and candles fixed in insecure positions. Entertainments of this sort are of such usual occurrence that it would be well if the larger rooms of school buildings were designed to accommodate them.

Entertainments given in private houses, which are quite inadequate to accommodate the number of people they are called upon to hold, are another source of danger. On such occasions houses are not infrequently filled to such an extent that to move from one room to another is almost an impossibility, while the staircase is totally inadequate to allow the people to escape in case of fire. The remedy for this lies to some small degree in the hands of the designer, for he can provide ample door openings and staircase accommodation, but the safety of the guests must chiefly depend upon the discretion of the host, who should proportion his entertainments with regard to the accommodation of his house; while, on the other hand, by placing furniture across doorways in passages, he may do much to render useless the provisions made by the architect.

Entertainments in private houses or in other places are often rendered particularly dangerous by the very general practice of decorating with flimsy hangings and many small lights. Such hangings on catching fire will fall against other inflammable material, and the spread of fire will be rapid, while a large quantity of smoke will be produced by its combustion.

Temporary Erections.—Temporary wooden erections used for entertainments, bazaars, etc., unless special care be taken in their construction, may become fire traps of the worst order. Wooden stalls draped with flimsy material will be distributed about the floor space, while possibly the whole roof and walls may be covered with bunting. Such an arrangement forms an ideal ground for the spread of fire with appalling suddenness. It is most important, then, that all materials, wood, and draperies used in an erection of this description should be chemically rendered non-inflammable. Numerous and ample exits should be provided and should be clearly labelled. Buckets of water and chemical extinguishers should be kept in readiness for the immediate extinction of an outbreak of fire.

Churches.—While considering the subject of personal safety, churches must not escape notice. The occurrence of fire in a church is by no means an uncommon event. The heating apparatus in close proximity to the organ is a common cause of fire. Although the outbreak may be small, the consequent panic may result in many fatalities. Provision for rapidly emptying a church is, however, rarely made, although many disastrous church fires have proved its necessity. Thus the width of aisles and door openings should be ample, while doors should open outwards, and should never be locked while a service is being held. Gallery staircases should be planned on the same principles as those discussed in reference to theatres: they should lead directly to the open air, and must never lead to an exit to be used in common with people from the floor of the church.

CHAPTER IV

INNS AND PUBLIC HOUSES

THE quiet little country inn, which is unfortunately passing away in favour of the more vulgar public house and pretentious gin palace, is essentially a cottage, some rooms of which are devoted to public use, while in many of the best of them a few bedrooms are reserved for casual travellers. An illustration of one, the Bull Ring Inn at North Shields (see Fig. 9), designed by Mr. F. R. N. Haswell, F.R.I.B.A., and planned in accordance with the old traditions, is, however, given. The whole of the front is devoted to a large open bar having window seats with tables arranged in front of them, and a fireplace at each end of the room, forming a kind of club, such as is essential in village life, at which the men can meet and chat of an evening while enjoying their smoke and a modest glass of beer. This, it will be noticed, is something quite different from a mere drinking saloon. The customers do not come in, drink, and go out again, but sit in the bar, perhaps for hours, using it as a meeting-place for discussion and general sociability. There is the bar counter, certainly, at which casual callers can be served, and a certain concession to modern requirements is made by screening off a small portion for jug and bottle trade, this being served from an entrance lobby or passage and not from the front door. The cellar flaps in the pavement in front and also in the floor behind the bar counter will be noticed, leading down in a primitive manner, the one by slides and the other by a step-ladder, to the cellar below. There is a block at the foot of the slides to receive the barrels as they are let down by ropes, and gantries or stands for the barrels are provided round the bar cellar. This being a small inn, the sale would be almost entirely of beer in some counties and cider in others, and scarcely at all of spirits or wines. At the back of the bar on the ground floor two sitting-rooms will be noticed, one of them being what is often called a bar parlour with seats round the walls, and standing tables where refreshments can be served, and the other, or best sitting-room, being also intended for guests. Both of them can be served from the space behind the bar counter, but the latter only has direct service from the kitchen upstairs, so that it alone could be used for meals. As a general rule the kitchens are found on the same floor, but with limited space it has been necessary in this case to place them on another level. The object aimed at in all buildings of this type is that of cosy comfort, representing home-life on a larger scale, and in fact many of the older country inns have a combined kitchen and bar in which the family live, while all cooking is done in view of the guests. After what has been said in previous volumes about the planning of country houses and cottages it is not

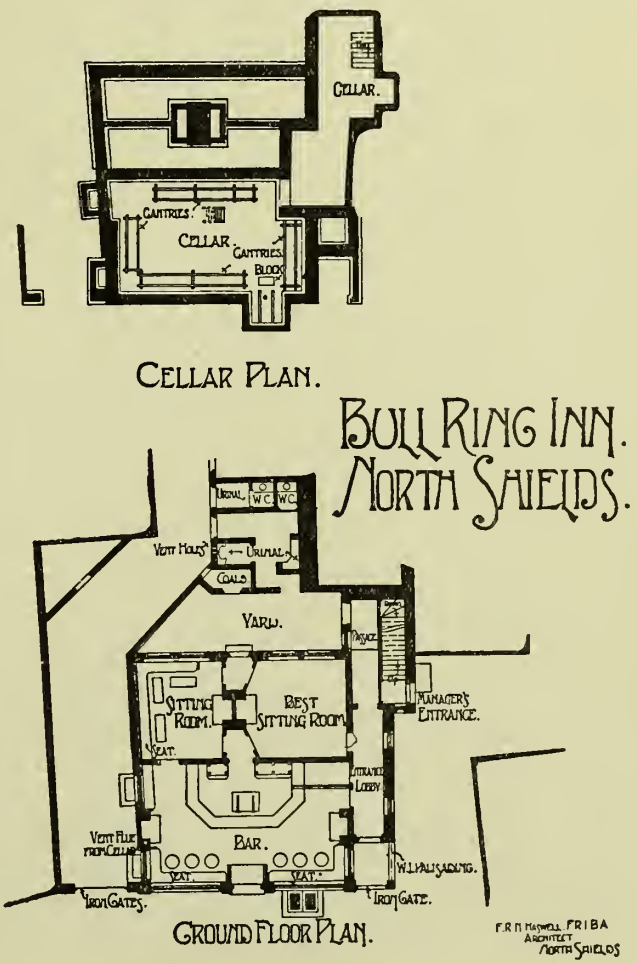


FIG. 9.

perhaps necessary to enlarge upon this aspect of the matter.

Another cleverly planned little inn is "The Chequers" at Felstead, designed by Messrs. C. & W. H. Pertwee (Fig. 10). The public portion is differentiated from the parlours in which meals would be served, a passage-way passing between, while the kitchens also are distinct, and the serving bar is so placed as to give convenient access to public bar, taproom, and bar parlour, with a beer cellar on the same floor, approached from the back

and arranged in very small compass. The plan is worth a good deal of study, the exceedingly comfortable taproom being a particularly noticeable feature, so placed as to be of an unusually private character.

Much more pretentious are the modern inns, which are replacing those of the above-mentioned type in many a country village and in the suburbs of the larger towns. These new buildings are often dignified by the name of hotel, though they scarcely deserve it, as this title ought to be reserved for buildings which provide mainly for persons who stay in them for the night and so use them as temporary homes. A typical example is the Crown Hotel at Dulwich (Fig. 11), designed by Messrs. Eedle & Meyers, MM.S.A. There is some slight attempt in it, though not a great one, to introduce a sense of comfort similar to that so noticeable in the old country inn, while the somewhat rare adjunct of a skittle alley is added, as well as the more modern features of a large billiard-room and a complete suite of rooms for the meetings of a Masonic Lodge. On the ground floor the bar of the public-house is replaced by the saloon bar of the gin palace, the open seats and bar counter suggesting its use for drinking purposes rather than as a club or meeting place, while the coffee-room, so called, which opens out of it, is intended for the service of solid refreshments, having lifts in one corner, by means of which the kitchen on the second floor can be reached directly. The impression given by the plan.

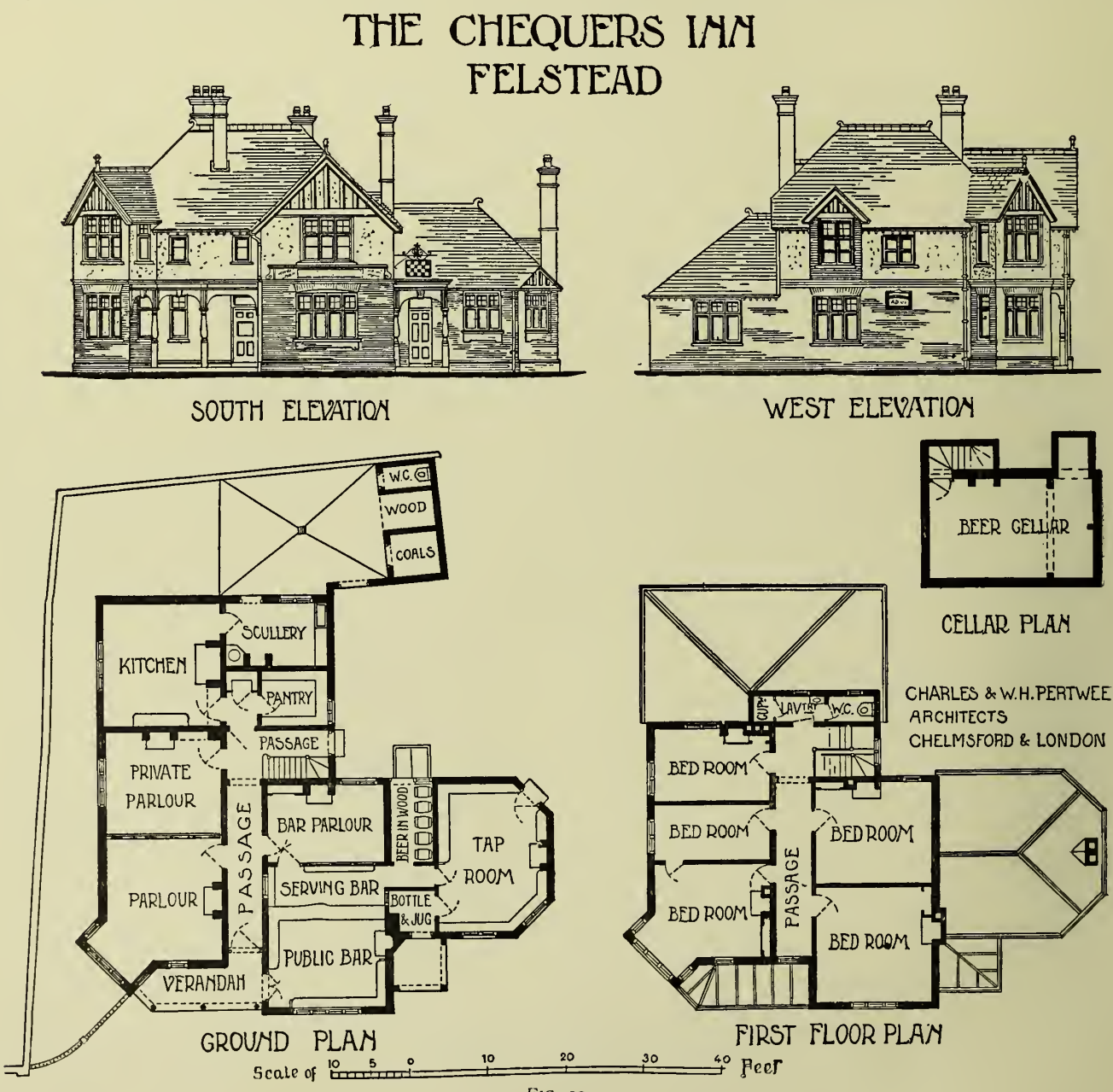


FIG. 10.

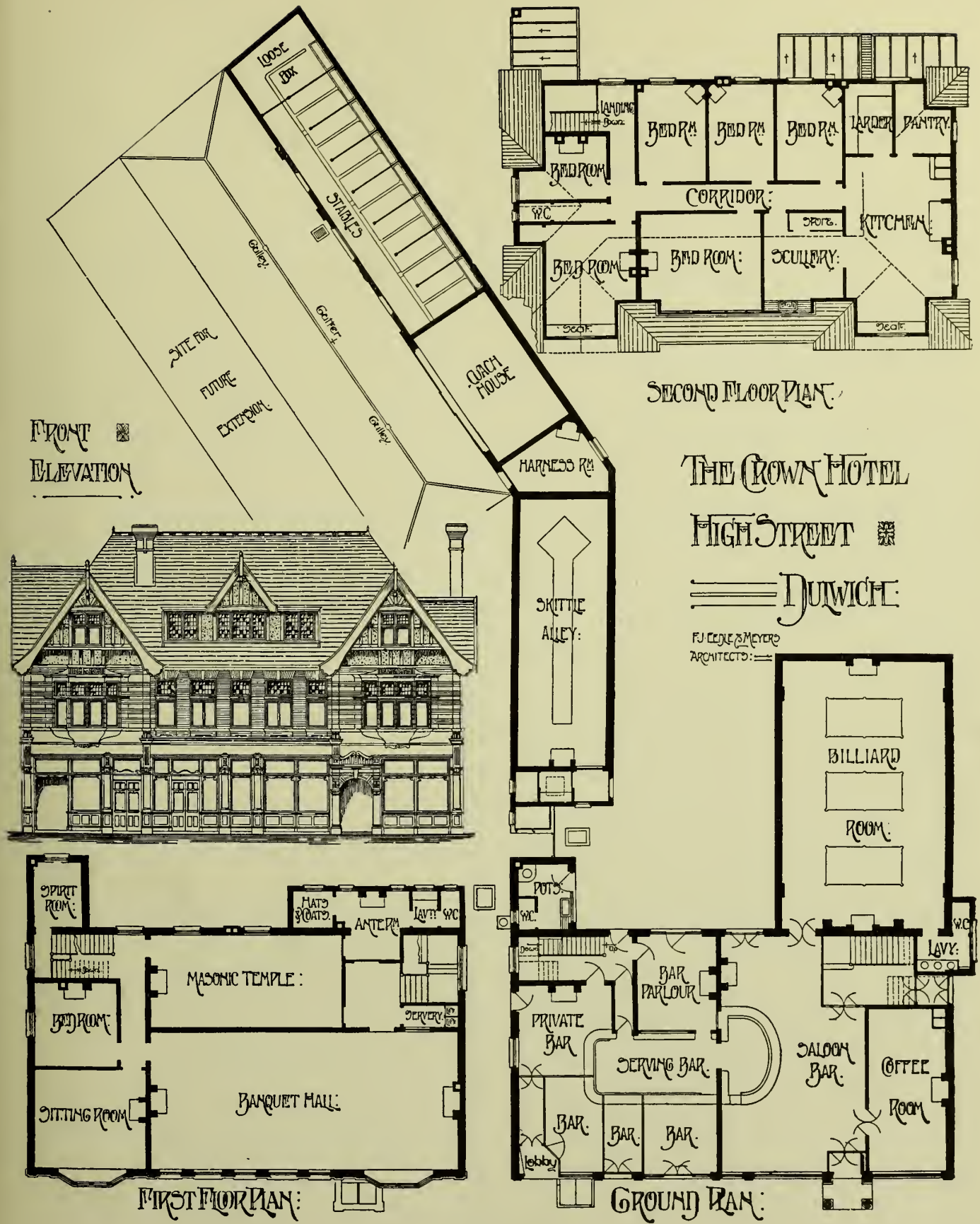

THE CROWN HOTEL
HIGH STREET
DULWICH
F.J. CEDLE & MEYERS
ARCHITECTS
FRONT ELEVATION
SECOND FLOOR PLAN
FIRST FLOOR PLAN
GROUND PLAN
LOOSE BOX
STABLES
GALLERY
GALLERY
SITE FOR FUTURE EXTENSION
COACH HOUSE
HARNESS RM
SKITTLE ALLEY
LANDING
BED RM
BED RM
BED RM
LARDER
PANTRY
BED ROOM
CORRIDOR
W.C
STORE
KITCHEN
BED ROOM
BED ROOM
SCULLERY
SCALE
SCALE
SPIRIT ROOM
HATS & COATS
ANTE RM
LAV!
W.C
MASONIC TEMPLE
BED ROOM
SERVERY
SITTING ROOM
BANQUET HALL
POTS
W.C
BILLIARD ROOM
W.C
LAVY
BAR PARLOUR
PRIVATE BAR
SERVING BAR
SALOON BAR
COFFEE ROOM
BAR
BAR
BAR
Lobby

FIG. 11.

is that the bar would be served by barmaids and the coffee-room by waiters in evening dress, replacing the old attendants of the public-house with coats off and sleeves tucked up. This portion of the building is carefully divided off as for the better class of customer, and out of the saloon bar the large billiard-room with its top light is immediately reached, while there is also a means of access to the first floor. Small bars, set apart for the lower class of customer and for a jug-and-bottle trade, are controlled from the same serving counter and serving bar, the planning of which is managed with great skill. There is a private bar which can be reached by a side entrance as well as from the secondary lobby, and at the back there is a bar parlour for more occasional visitors and extreme privacy. The staircase at this end of the building is for the use of the staff and for the few persons who might utilise the house for sleeping purposes, as on the first floor it serves a sitting-room and bedroom together, with a spirit-room off the half-landing, this being obtained over the little washing scullery for cleaning the pots.

The arrangement of the Masonic rooms, now almost necessary in all buildings of this type, is noticeable, each of the two principal rooms being capable of being utilised for suppers, banquets, or balls, as need may arise, as well as for purely Masonic purposes, and all being readily served from the kitchen lifts.

The top floor contains the kitchen and several bedrooms, the kitchen accommodation being ample even for large banquets in the rooms below. The back of the site, as will be seen from the ground-floor plan, is given up to large public stables consisting of one loose box and seven stalls and a coach-house and harness-room, with a large yard in front of them; while provision is made for additions in the future should the need arise—as it probably would do before long—for a motor garage. Stables will be dealt with in greater detail in a later part of the volume, and therefore there is no necessity at this moment to say more about them.

Still greater departures from the country inn, out of which they are developments, are the great London combined drinking saloons and places of refreshment, such as the Angel at Islington, also designed by Messrs. Eedle & Meyers, of which four plans are given in Fig. 12. In this the various bars and the service portion, as seen on the ground plan, are arranged centrally in much the same way as at Dulwich, though the site is more restricted and greater use is made of lifts; while two staircases are shown, one for public use in a broad entrance, and the other entirely for service. The whole of the back of the site is occupied by a large buffet and saloon bar, to be utilised to a great extent for the service of luncheons, and top lighted, out of which a staircase drops to the billiard-room in the basement, which is only lighted artificially. At the back of the serving bars are stands for bottles, with a small office behind them, while underneath is a beer cellar and heating apparatus, there being even a sub-basement for further cellars.

The first floor is given up entirely to a large grill and dining-room, which occupies the whole of one frontage and would be used principally by lunchers and diners, and to a coffee-room for the service of meals for those using the place as an hotel, there being a combined servery and still-room for supplying each of these, the former across the landing of the back stairs, and the latter through a servery hatch. The main staircase does not proceed above this floor, where it is replaced by a more private inner stair for hotel use, leading up to the second floor, on which is a smoking lounge for hotel residents as well as a number of bedrooms and a rather curiously placed bathroom. On the second floor the back stairs are changed in position on account of a certain portion not being carried up farther. The third floor is almost identical, the smoking lounge being replaced by an additional bedroom, and the hotel staircase going up no farther. The method of lighting this staircase does not appear on the illustrated plans, but would be seen if the third-floor plan were illustrated. There is a good deal of heavy brickwork on these upper floors, particularly in the chimneys, which has to be carried by girders, but this presents no difficulty if modern steel construction be adopted. The chimneys are generally arranged so as to group the flues and to permit of beds being placed comfortably in the rooms.

There are yet two more storeys, the fourth and fifth, and the kitchens occur on the fourth floor, being served for most purposes by the large lifts, while themselves serving the various dining-rooms and bars by means of the smaller lifts. The large lift is carried right from bottom to top of the building—from sub-basement to the fifth floor; while the smaller lifts commence on the ground-floor level and go up to the fourth floor only. A large storeroom is interposed between the kitchen and the staircase corridor, a scullery also serving somewhat in the same way to cut off the smell of the cooking from the bedrooms on this floor. At this level the angle takes a circular form, which is more emphasised again on the fifth floor, where the circle is complete, the room being used as a sleeping place for bar attendants; for this top floor is naturally given up to the staff bedrooms and to a large larder above the kitchen—a most sensible and airy position for such a room, where it would be possible to ventilate it thoroughly.

Attention may be devoted to the general scheme of planning illustrated in Figs. 11 and 12, which is the same in both examples, namely, that of placing the bar counters and serving space in the middle of the building on the ground floor, and arranging the various rooms and bar compartments radially outwards, so that all are under the control of the attendants in the centre, and can be equally well served by any of them, and with all the different things which are on sale.

The way in which this arrangement works in

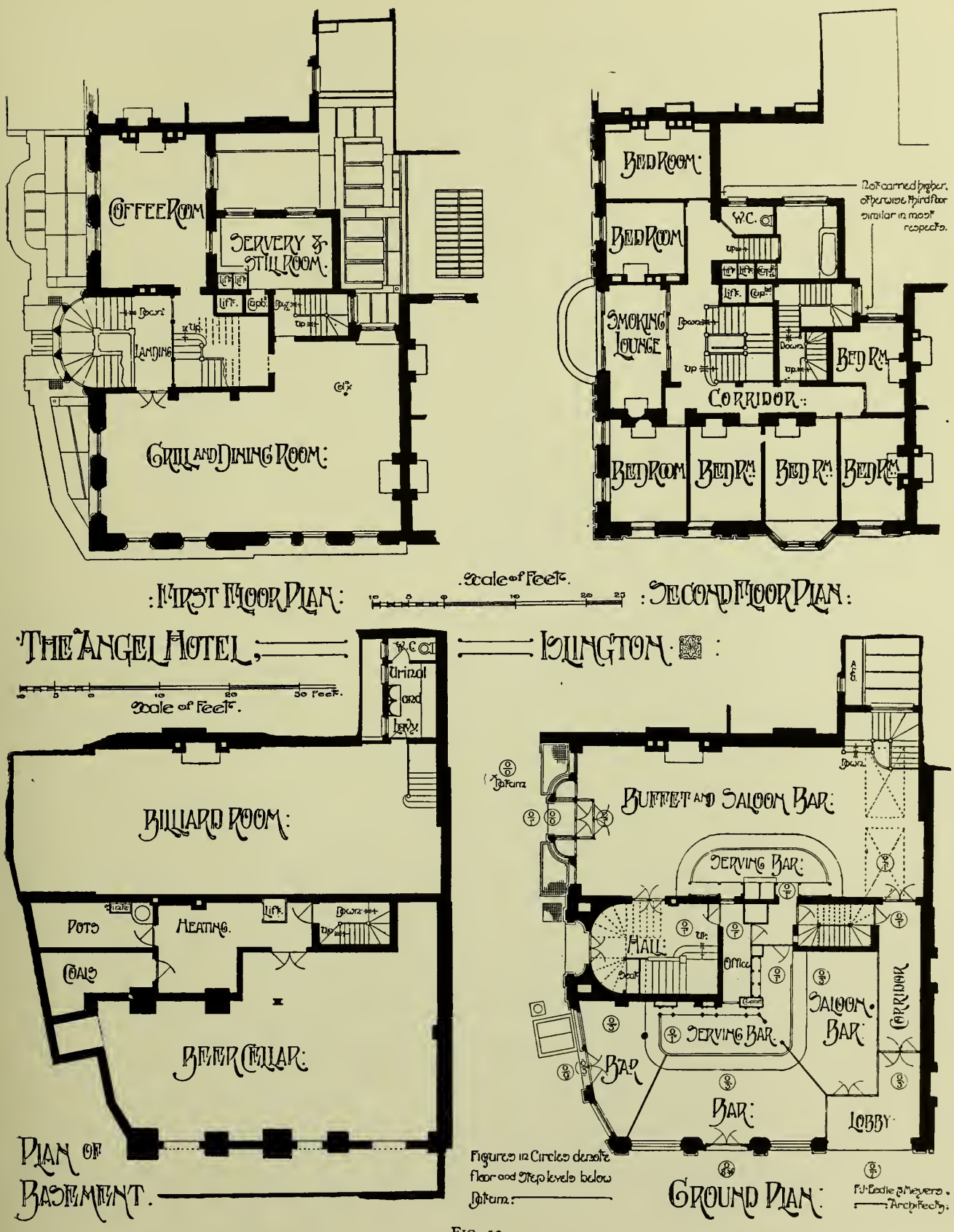

Coffee Room
Servery & Still Room
Grill and Dining Room
Landing
Lift
Cupb.
Down
Up
W.C.
Bed Room
Bed Room
Smoking Lounge
Corridor
Bed Rm.
Bed Room
Bed Rm.
Bed Rm.
Bed Rm.
Not carried higher, otherwise third floor similar in most respects.
First Floor Plan
Scale of Feet.
Second Floor Plan
The Angel Hotel, Islington
Scale of Feet.
Billiard Room
Pots
Heating
Coals
Beer Cellar
Urinal
Plan of Basement.
Buffet and Saloon Bar
Serving Bar
Hall
Office
Saloon Bar
Corridor
Bar
Bar
Lobby
Figures in Circles denote floor and step levels below Datum.
Ground Plan
F.J. Eadie & Meyers, Architects.

FIG. 12.

actuality can be well seen on the two photographs on Plate II., which represents the saloon bar and the private bars of the Dover Castle Hotel, Waterloo Bridge Road, designed by Messrs. Treadwell & Martin. In the saloon bar there is a wide open space in front of the counter, which has seats or stalls ranged round it for the use of what are known as standing lunchers, there being a brass rail at the bottom of the counter front for them to rest their feet upon as they half stand and half sit to take a hurried lunch at the bar counter, upon which are arranged a few permanent stands for food and glasses, as well as a hot-water urn; while at the back there is a series of shelves with mirrors behind them for bottles, glasses, and cigars, while a money check occupies the centre. The arrangement of the dining saloon can be seen also through the open doors. In the private bar the arrangement is much the same, the partition at the back not being carried right up to the ceiling, and being so far open that a view can be obtained, past vertical barrels for spirits, into a similar counter space on the other side. Other spirit barrels occupy the upper part of the partition. These are sometimes dummies, but in the present instance are intended for actual use, the pipe and gauge being shown upon the front, indicating how much is left in the barrel at any time. The beer pulls will be noticed on the counter, as well as the hot-water urn. It may be noted here that all pipes for beer should be of tin-lined lead, so that beer standing in them over night may not become lead poisoned. There is always a tray beneath the taps from these pulls, to catch the drips and into which wastage can be thrown. This is generally of lead, but also is preferably tin-lined, as again should be the pipe leading from it to the wastage cask in the cellar,—for beer wastage is saleable to a brewery.

The elaboration of design is always considerable, and may be carried to any excess, though modern experience shows that extravagant expenditure is not justified by the return, and that plainer work will suffice so long as there is brightness and the glitter of light and glass combined with extreme cleanliness.

SALOON BAR.

PRIVATE BAR.

THE "DOVER CASTLE," WATERLOO BRIDGE ROAD, LONDON, S.E.

[Messrs. TREADWELL & MARTIN, ARCHITECTS.

CHAPTER V

HOTELS

CONTEMPORANEOUSLY with the development of the country inn into the large public-house and refreshment bar has been its perhaps more legitimate change or growth into, first, the country hotel, and steadily from that to the great palace hotel, such as is being built at the present time in all great cities. As a rule the small country hotel shows its origin pretty clearly, having often been built upon the site of a hotel or inn of former days. These were frequently planned on the continental system, round an internal courtyard into which the stage-coaches could be driven to discharge their passengers. Frequently there was not only an archway from the street, but a second archway on the farther side of the court leading into the stables, these being occasionally, as they are frequently still found in country places on the continent, located underneath a whole wing of bedrooms. This courtyard plan, however, is hardly suitable to our climate, and it has given way gradually to the covering of the whole site, and to an arrangement which partakes to a certain small extent of that of the inn, frequently containing tortuous passages, with a considerable amount of waste space in consequence, due not to bad planning on the part of the architect of the present time, but to gradual enlargement on the old lines and a disinclination to pull down entirely when the alterations have been made.

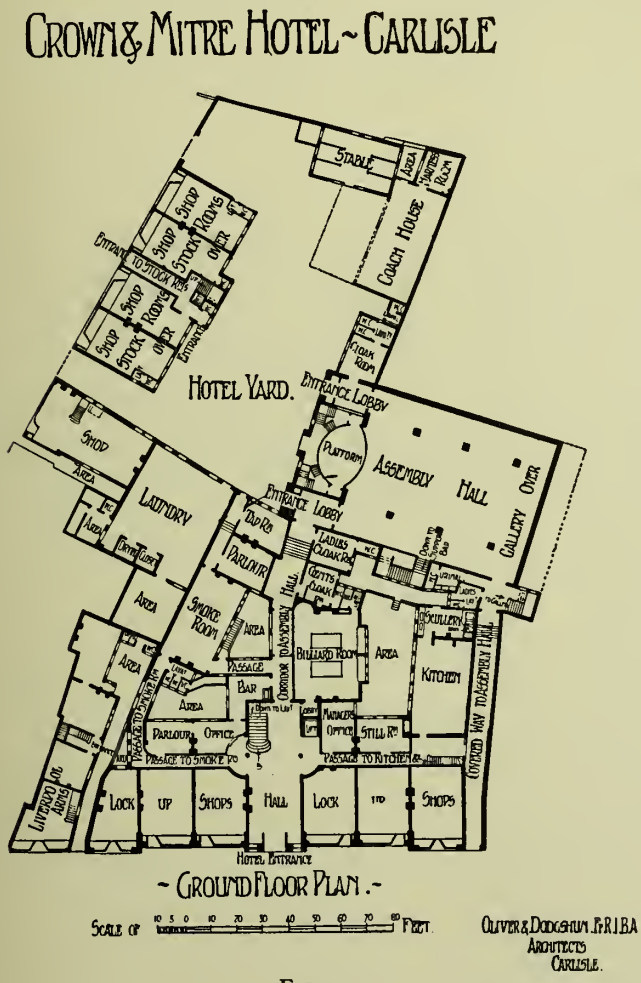
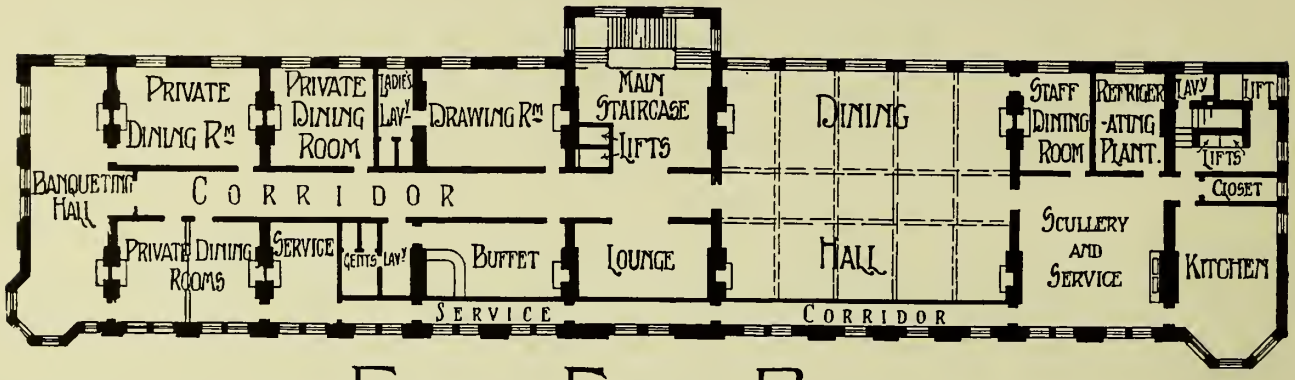


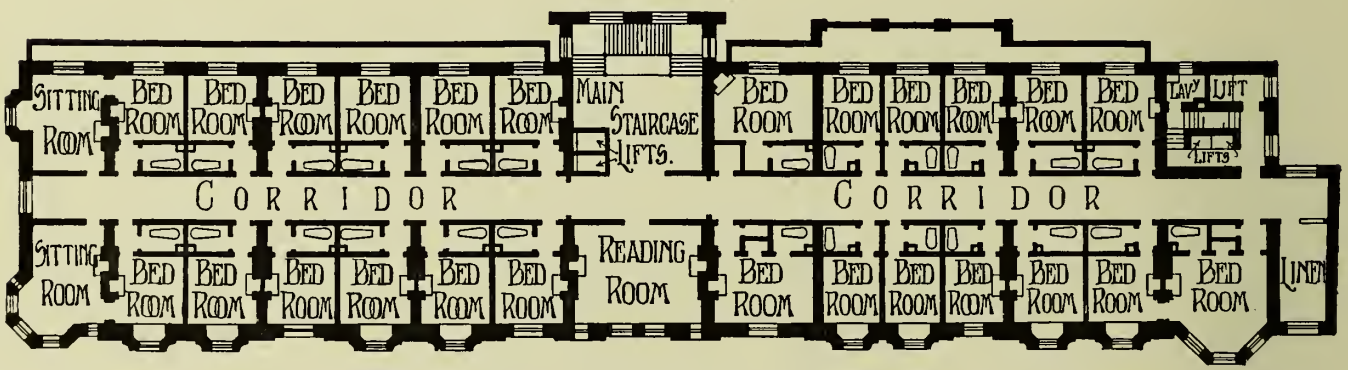
FIG. 13.

In Fig. 13 the plan is shown of the Crown and Mitre Hotel at Carlisle, as remodelled by Messrs. Oliver & Dodgshun, which has developed somewhat after this fashion, together with the neighbouring small Liverpool Arms, practically under the same management. There are frontages to two roads, and each of these is occupied on the ground floor, except for the small frontage of the Liverpool Arms, by lock-up shops. The main frontage has the hotel entrance in the centre, through a broad vestibule or hall into a large staircase hall, whence stairs rise to the bedrooms, which are all located on upper floors, together with the dining-rooms and coffee-rooms which are necessary for the use of the residents. There is a lift also opening out of this hall for passengers and luggage, close against the manager's office, which is so placed as to control the entrance and also the passage to the kitchens. These are situated down the side of a covered entrance, and can thus be served without tradesmen passing through the main entrance. The plan is to a great extent, in this particular instance, controlled by the fact of there being a large assembly hall at the back, to which there is an entry by means of a central corridor from the hotel, as well as a gallery entry by the side of the main building from the main road; while there are still other entries, both for public and performers, from a large hotel-yard in the rear, access to which is obtained from the side street. There is a billiard-room in the middle of the site, lighted from the kitchen area, and placed on the ground floor, so that it would be used by town's folk as well as residents, and would by them probably be utilised to a considerable extent as a club, it being comfortably arranged with a large alcove and good window seats, while it is situated close to a bar, which, however, is too small to become a regular drinking saloon. A smoking-room is placed in an out-of-the-

~The Palace Hotel~ Shanghai~

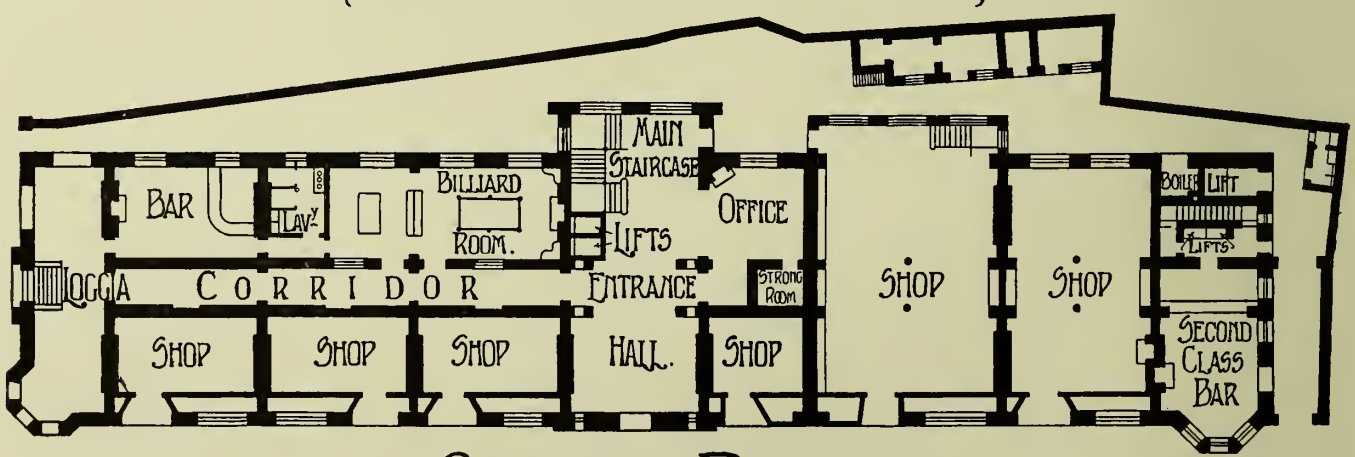


Fifth Floor Plan.



First Floor Plan.

{2nd, 3rd, & 4th Floor Plans similar.}



Ground Plan.

SCALE OF 10 5 0 10 20 30 40 50 FEET.

Scott & Carter.
Architects.

Fig. 14.

way corner, with taproom and parlour beyond it, the former having its windows in an entrance from the hotel yard. A large laundry, opening out of the yard, is a somewhat unusual feature.

The frontage to the side road is taken up by shops, as has already been said, except that in the centre there is an entrance to a series of rooms known as stock-rooms, another entrance to which is obtainable

Scott & Carter, which is illustrated in Fig. 14, is a further development; and although it is built elsewhere than in England, it may be taken as a step between the English hotel and the greater erections which are now being put up in the metropolis and other large cities upon what is more or less a trans-Atlantic system. The comfort of the little country place is entirely put aside in favour of a large formal building containing

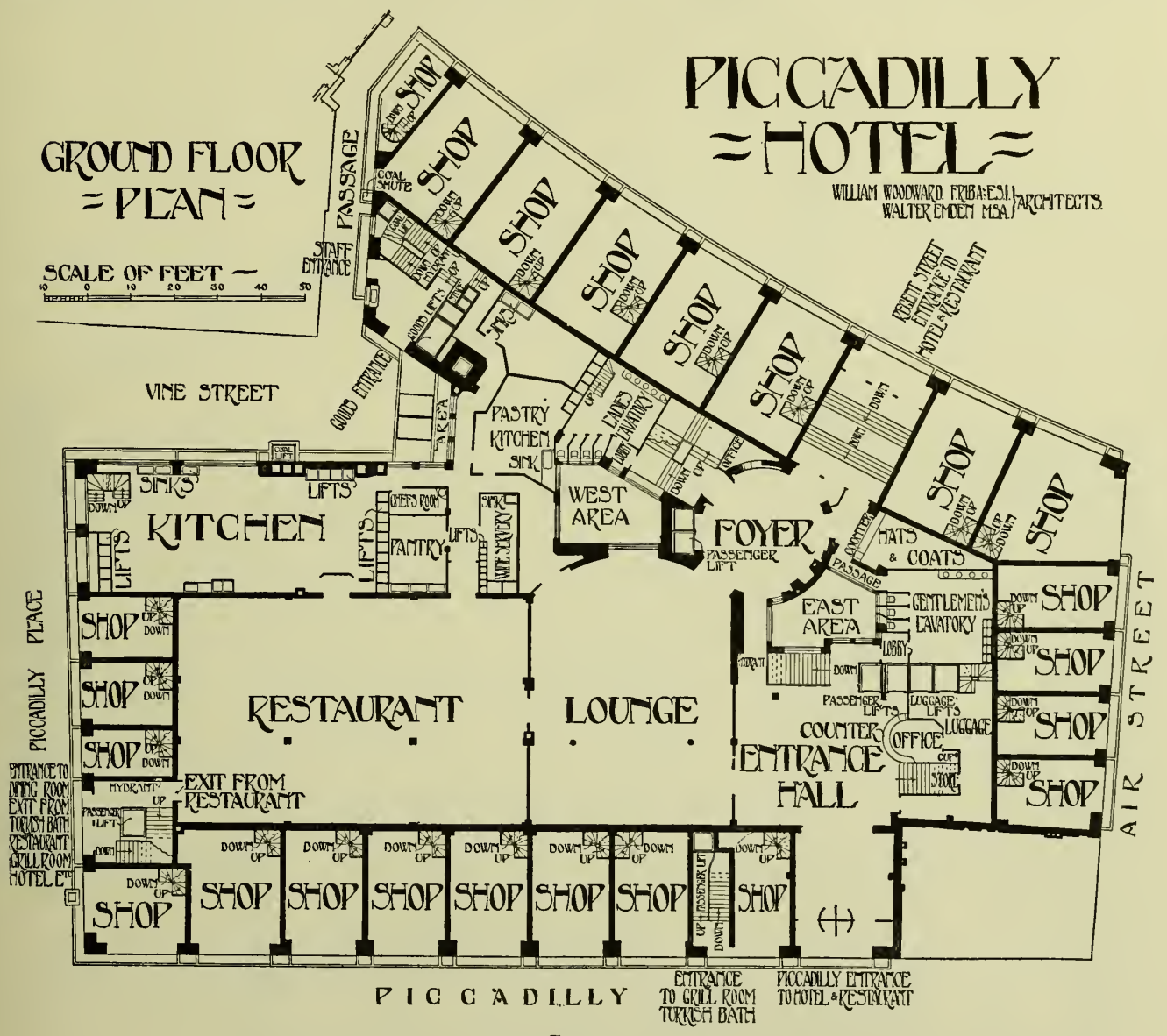


FIG. 15.

out of the yard, while they are served both by staircase and lift. These are necessary adjuncts to a provincial commercial hotel of any size, as they are intended for the display of goods by commercial travellers, who have their large packages brought there and opened, and the contents shown upon tables or counters, their local customers being invited to inspect and order from the stock thus displayed.

The Palace Hotel at Shanghai, designed by Messrs.

handsome reception-rooms and a large number of separate bedrooms, while the ground floor is, as with many other classes of buildings, cut up into small shop frontages, which can be let off and so add to the income of the establishment. At Shanghai there are two bars perfectly detached on the ground floor for outside custom, and also a billiard-room; while the middle of the site is occupied by an entrance hall, staircase, and lifts, together with a manager's office. The central

staircase runs right up the building, and serves large dining and drawing-rooms, lounges, etc., on the first floor, which is planned, perhaps not too satisfactorily if considered from an English standpoint, with a long central corridor, and also with a narrow service corridor along the main frontage to enable the more

to it, so placed that it must be lighted by electricity. This plan is not given as an example of what is best to follow under all circumstances, but merely as illustrating a transitional stage, for which we have to look to other countries.

As an example of a great modern hotel we may

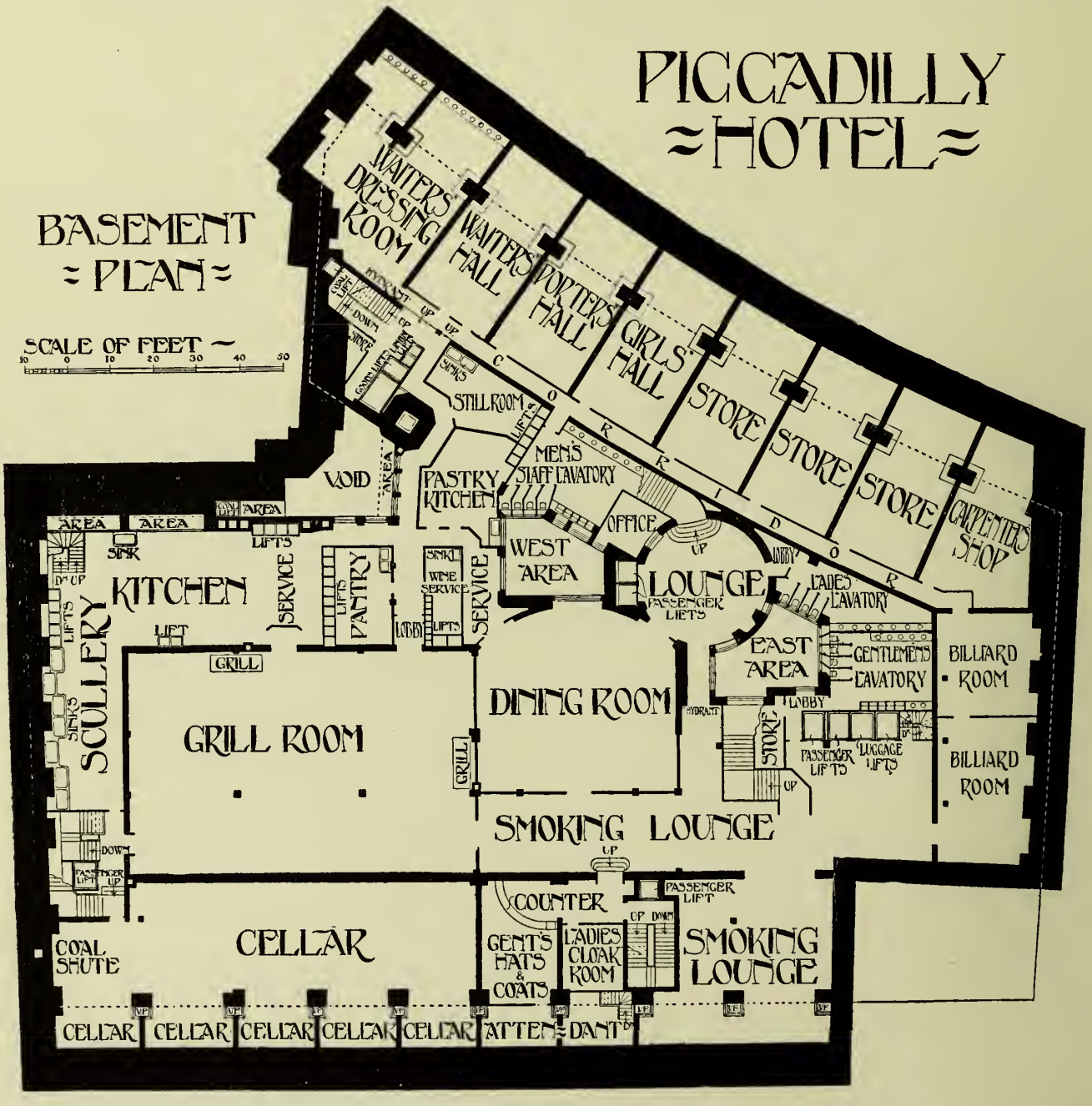


FIG. 16.

distant banqueting hall and private dining-rooms to be served from the kitchen. The top floor also suffers through having a long corridor, comparatively unlighted, from end to end of it, while it consists of little else than bedrooms, two private sitting-rooms only being provided, while each bedroom has a bathroom attached

take the "Piccadilly" (Fig. 15), now in course of erection from the designs of Messrs. Wm. Woodward, F.R.I.B.A., and Walter Emden, M.S.A., acting as joint architects so far as the plan is concerned; while the elevations are the work of Mr. R. Norman Shaw, R.A. The site is a large one, facing Piccadilly on the

south and the quadrant of Regent Street on the north-east, while it is also bounded by Vine Street and Piccadilly Place on the west, and Air Street on the east, though it is irregular in outline along these frontages. It was naturally desired to introduce as many shops as possible, and consequently all the important street frontages are given up to them, except for comparatively small portions devoted to the hotel entrances. itself, with grand staircase, office, and lifts serving all floors for passengers. The luggage lifts only occur behind the office on the Piccadilly side. From both foyer and hall there is access to a large lounge, the great meeting-place of the hotel, and from this there is an axial entrance to a restaurant, which can be also reached independently from Piccadilly Place, and is therefore capable of being used by other than hotel resident

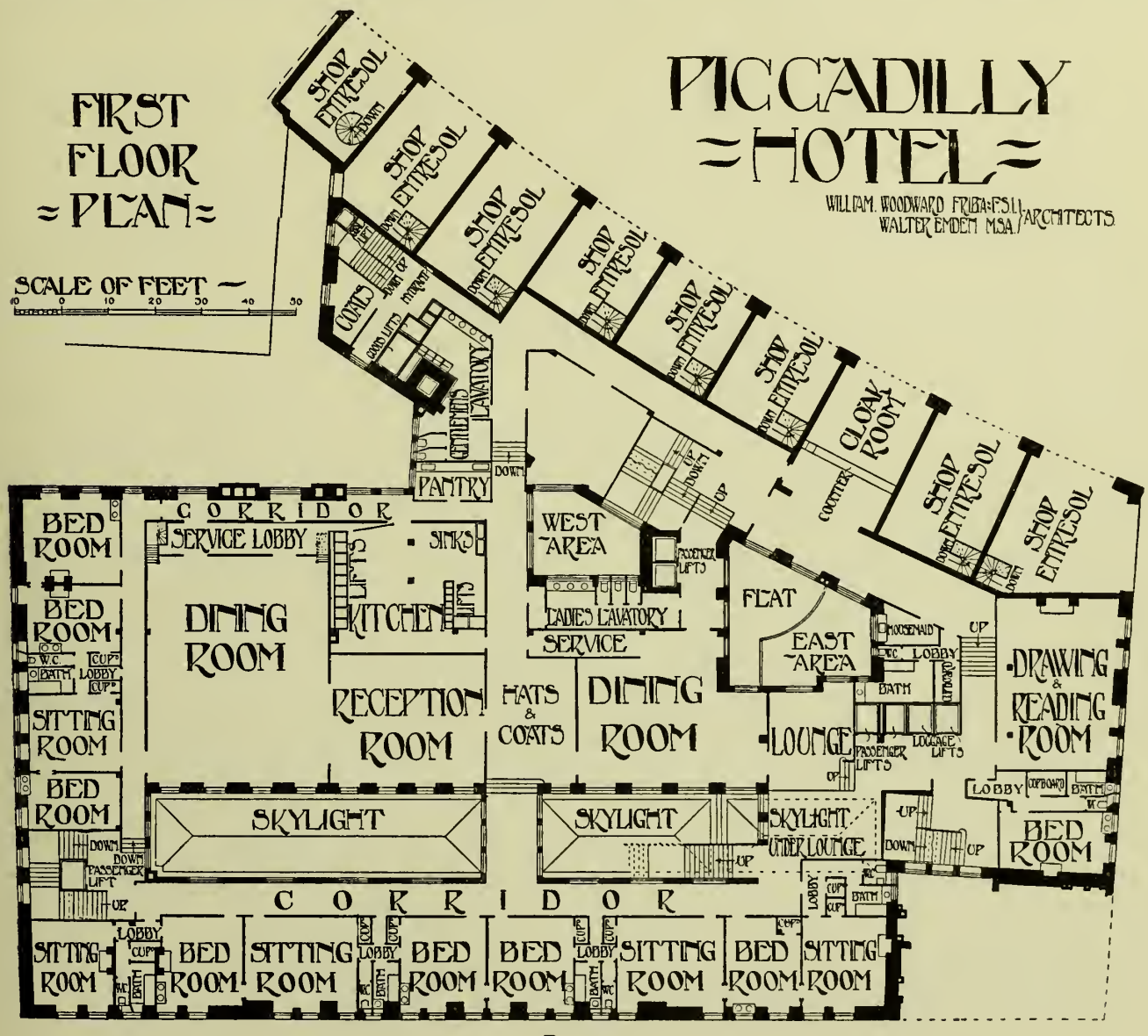


FIG. 17

Vine Street, being a side street, is utilised for the staff and goods entrance, and the main kitchen is placed there on the ground floor. The shops are all of two storeys above the pavement, these ranging with one floor of the hotel, and similarly they have entresol basements. The hotel proper has main entrances to the great thoroughfares of Piccadilly and Regent Street, the former leading to a large entrance hall and the latter to a foyer or circular hall, each complete in without necessarily entering the hotel. The kitchen adjoins this restaurant, and contains a large number of lifts, from which many floors can be served, similar lifts being also placed in the wine servery and pastry kitchen; for there is a complete kitchen establishment both on this floor and in the basement, communicating by means of a stair at the corner between Vine Street and Piccadilly Place, and consisting on each floor of kitchen, pantry, wine service, pastry kitchen, and stillroom. At first

sight the plan appears to be exceedingly complicated, this being due to the arrangement of the shops round the borders of the site and of the hotel within.

The basement plan shown in Fig. 16 is very similar to that above it, but somewhat larger, as cellars are carried beneath the pavements both of Piccadilly and of Regent Street, while it is bounded by enormously thick retaining walls. As has already been said, there are

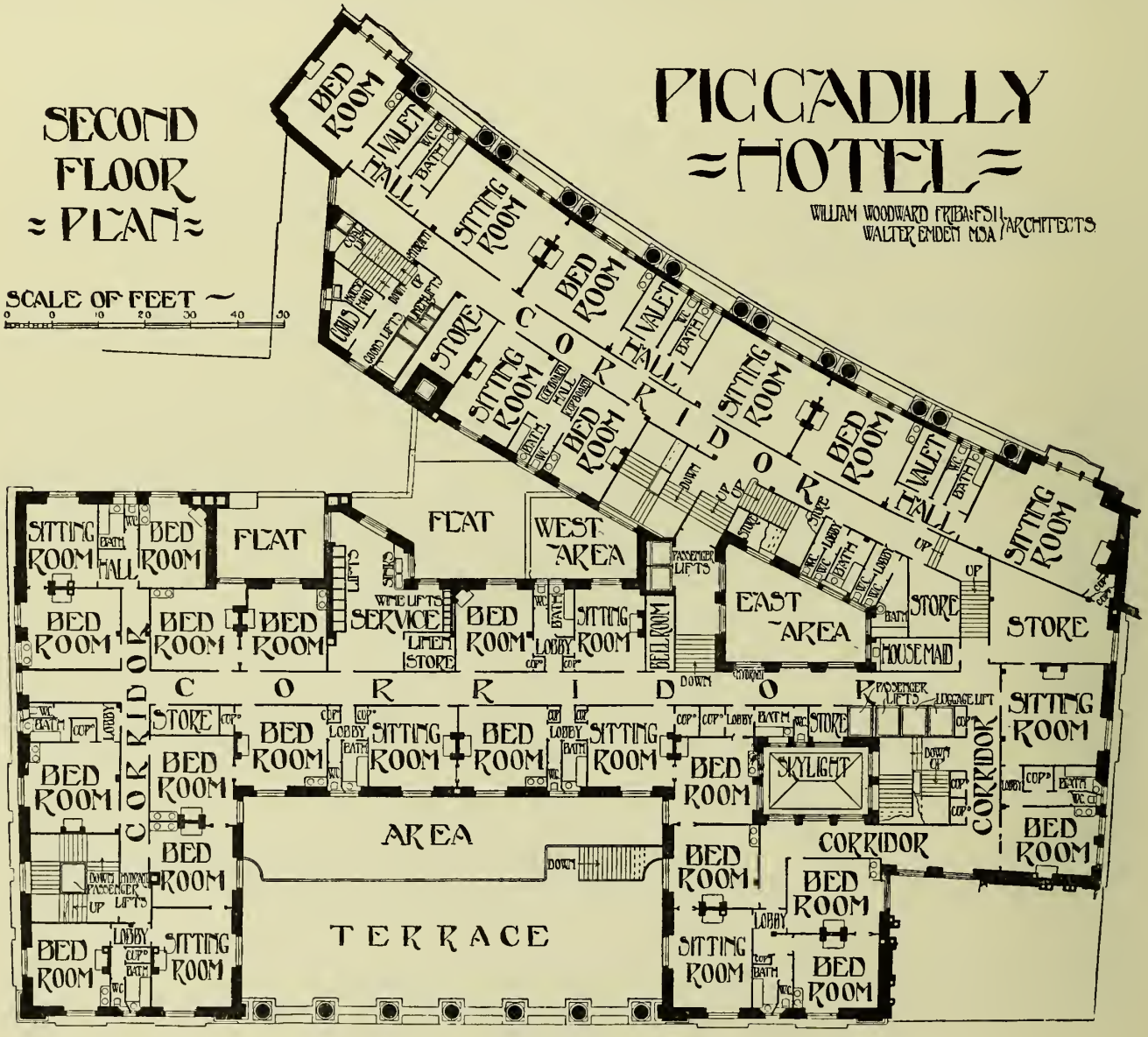


Fig. 18.

entresol cellars between this floor and the ground floor beneath all the shops, the spaces beneath these being here given up partly to cellars and storerooms and partly to a series of separate servants' halls for the waiters, porters, and women servants, and to two billiard-rooms. The main staircases are both carried down to this floor, and open, the one into a circular lounge beneath the foyer, and the other into a smoking lounge underneath the entrance hall, from which grill is artificially lighted, and consequently the architects had a comparatively free hand in the planning, the great features of which are the service corridors.

It will be noticed that, except that this is on a larger scale and for a different class of customer, there is much the same tendency to provide for non-resident lunchers and diners as there is in the larger city public-houses, and similarly the rooms are all of considerable size and luxuriously appointed, with the additional conveniences

of large lounges and halls, more exclusively for the use of residents.

Fig. 17 illustrates the first-floor plan, which it will be seen is more completely that of a residential hotel. The Regent Street frontage is even here occupied by the upper storeys of shops, but the Piccadilly and Vine Street frontages are given up to suites of rooms, generally arranged so that they can be let off in pairs or groups, a sitting-room and bedroom being usually grouped together, it being always possible to open communicating doors if desired. These suites are complete, each sitting-room and bedroom being provided with separate cupboards and separate bathrooms, all properly lighted from the exterior, while the bedrooms have standing washing basins. These rooms, occupying the exterior of the site, are all reached by internal corridors, which are lighted from large wells which also provide top light to the dining-room on the ground floor. The Air Street frontage is given up to drawing and reading-rooms, while the interior is devoted to hotel dining and coffee-rooms, served mainly from the kitchens on the lower floors, and having here only a service kitchen communicating by means of lifts with those below. There are also several service lobbies, pantries, etc., the general idea being to obtain ample internal communication, by means of which the servants can easily reach all parts without unnecessary interfering with the guests.

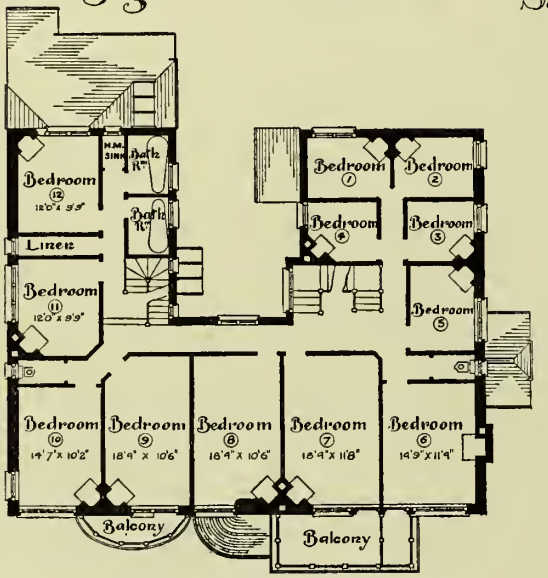
The same tendency to provide suites rather than single bedrooms is to be seen in the upper floors, of which that shown in Fig. 18 may be taken as a type. In many cases it would be possible here to provide groups of three or four, or even as many as six rooms, which would practically be independent residences within the great hotel, showing in a striking fashion the tendency at the present day to follow the American manner of hotel rather than home living. This floor is planned on the direct central corridor system, with two such corridors radiating from the main staircase, while the lift service is remarkable for its completeness. Similarly, the way in which all parts can be reached by the servants from the back entry from Vine Street, by means of the stair which runs up and down from the goods entrance shown in that position in Fig. 15, is worth noticing. On these upper floors, by means of enlarging the areas, it has been possible to obtain external lighting to all the rooms, though the corridors will to a certain extent have to depend on electricity even here. There are no great general reception-rooms, and the need for them scarcely exists so much in a hotel of this character as it does where the guests are provided only with private bedrooms and not with private sitting-rooms also. This is an American idea rather than an English one, but it appears to be becoming general, and doubtless future hotels of the larger character erected here will be upon this system, unless it be found to pay better to provide somewhat large bedrooms which can be utilised for sitting-room purposes also, as is commonly done upon the continent. There is no stinting of room, but plenty of space is given to provide comfortable and even luxurious apartments for which a high rent can be charged.

Boarding houses lie midway between private houses and hotels, and so may perhaps be best considered in this chapter ; an example being illustrated in Fig. 19, which represents the Eversleigh Boarding House or Private Hotel, at Seaford, designed by Mr. J. W. B. Blackman. Intended for erection on a sea frontage, the rooms are naturally arranged with a large amount of window space, and on the upper floors with balconies. The ground floor is a somewhat curious combination of hotel and private house, with an office close to the entrance and a smoking-room carefully arranged in an almost detached position. The kitchens are large and give ready access both to entrance and to dining-room, while the bedrooms on the upper floors are so arranged as to be let out either singly or in groups for families. On the top floor the division is carried so far that bedroom No. 18, intended for the proprietor, has doors opening on to two corridors, one apportioned to guests and the other reserved entirely for the servants.

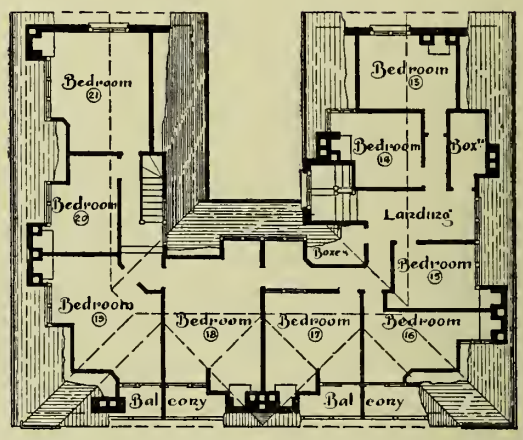
"EVERSLEY" SEAFORD. SUSSEX.

J.W.B. Blackman. P.A.S.I.
Architect.
Brighton & Seaford.

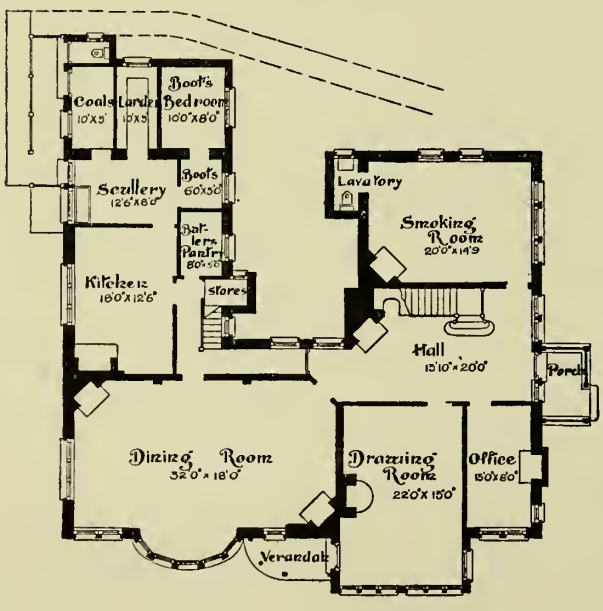
South Elevation.



First Floor Plan.

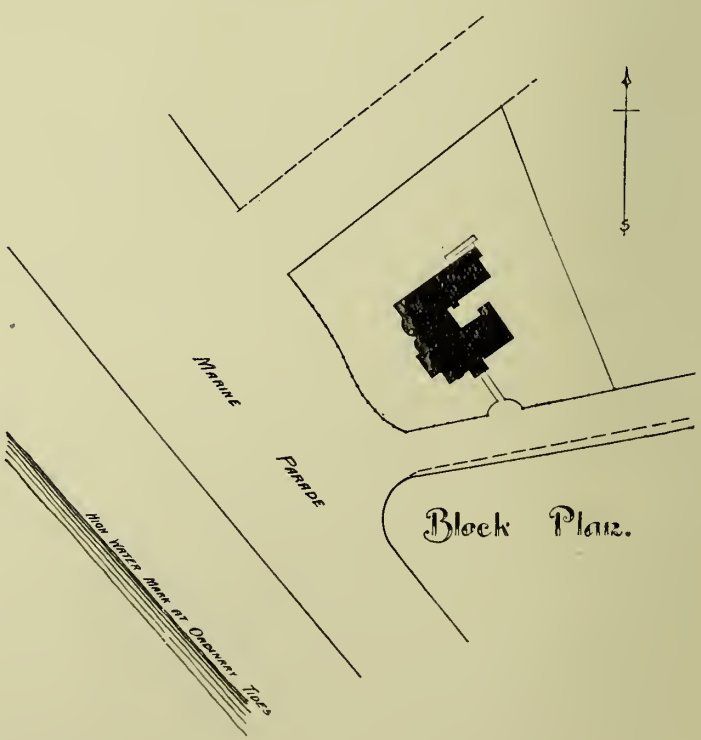


Second Floor Plan.



Ground Floor Plan.

Scale of feet



Block Plan.

FIG. 19.

CHAPTER VI

STABLES AND STABLE FITTINGS

(Contributed by H. C. Quêrée)

Horses and cows appreciate comfort, are sociable, and require careful treatment. Therefore it is our duty to make their homes pleasant, and to remove all that might be injurious to them, such as hard and sharp corners, door knobs, or in fact any projection which can be avoided. The air which they breathe may be rendered pure by means of good drainage and adequate ventilation.

The air may be admitted by window, "hit and miss" grating, or some such special appliance; but however

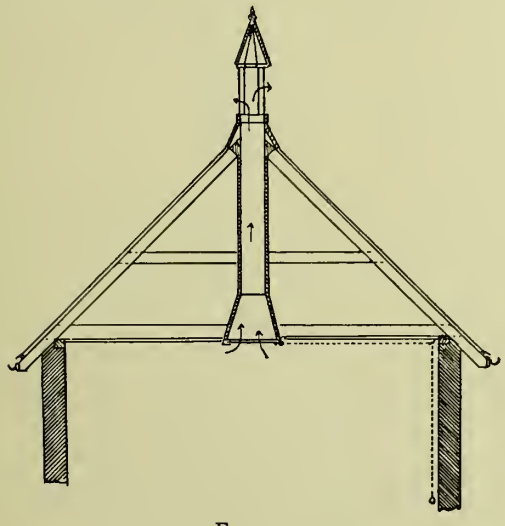


Fig. 20.

this may be done, it is necessary to provide some means by which the impure air may find its passage out. A foul-air shaft, taken from the ceiling to a ventilator of some description at ridge level, will afford the necessary means of exit. One or more shafts may be used according to the size of the stable, but they should be taken from as central a position as possible, although, for economy of space in the usual loft above, it is found oftentimes convenient to place the grating in a corner of the stable and to carry the shaft in line with the rafter. At the same time, it would appear wise to secure the best means of ventilation, even though it may mean some slight inconvenience. A fixed iron grating may be placed at the mouth of shaft, or else it may be covered with mesh wire or perforated zinc and have a wood door fixed in grooves, sliding so as to leave ventilator closed or open at will, and controlled by a rope and pull carried over a pulley and fixed at a convenient place. This is shown in Fig. 20, and is a very usual arrangement, but any other of the many systems of ventilation already described in full in Volume III. may be adopted.

Floors.

Stable floors have to be impervious, easily cleaned, not slippery, and such as will not require an over steep incline for drainage, and also of such a colour as will please and give the idea of warmth. When dealing with horse stables the part where most resistance is required is the floor of the stall, where the horse should stand as level as possible, and where he can kick and paw without wearing away the paving. The passage-way may be paved in some less resistant material, but, as a general rule, except where stables are built on the style of show places, the flooring is of the same material throughout. Portland cement concrete of one part cement to six of gravel should first of all be laid to a depth of 6 inches and to the required

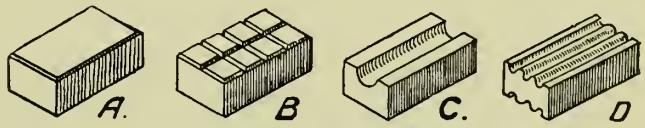


Fig. 21.

falls. The finished floor may be of grooved cement, but it has a tendency to become slippery, and soon cracks beneath the continued pounding of a horse's hoof. At A in Fig. 21 is shown a clinker brick of a dark yellow colour, 6 inches long, $1\frac{3}{4}$ inch wide, and $2\frac{5}{8}$ inches deep. It is made flat or with chamfered edges. For drainage purposes it should be so laid that the V-shaped groove—formed by the bricks being laid side by side—will conduct the urine in a straight course to the drainage channel. For passage-ways the bricks may be laid herring-bone fashion. This is also generally done in the stalls, effectiveness of appearance being studied instead of utility. The blue Staffordshire bricks (B, Fig. 21), made in 2, 4, 6, or 8 panels, and 9 inches long by $4\frac{1}{2}$ inches wide and 3 inches deep, give a most solid and impervious floor. Their drawback may be considered to be the difficulty of properly draining or cleansing

the chamfered channels, which continually cross one another at right angles. However this may be, in some localities they are general favourites, and are extensively used. The St. Pancras Ironwork Company have produced a paving brick of a blue-black or brown colour (C) which seems to meet a great many of the objections. The groove, semicircular in section, runs in the middle of the brick, so removing any danger of leakage from a faulty or weak joint. This, like the clinker, may be laid so as to conduct the drainage direct. It is claimed for these bricks that, on account

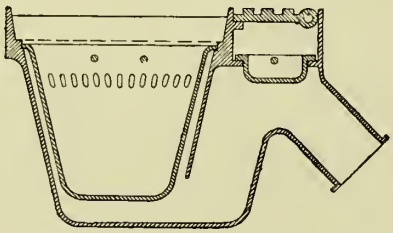


Fig. 22.

of the mixture of clays of which they are composed, they will never wear smooth, but always give a firm foothold. The fall required is so slight that the difference of level on length of stall need only be of 2 inches. Paving may be composed of bricks on end, but these wear out easily; or of granite cubes or rectangular blocks with roughened surface. They are apt to become slippery, and then require to be repicked. In granite districts they are extensively used, and are found to answer satisfactorily.

At D, Fig. 21, a corrugated form of the same brick is shown, specially adaptable to cow-houses and piggeries. For the former it has been found cleaner for the stall to be raised some 4 or 5 inches above

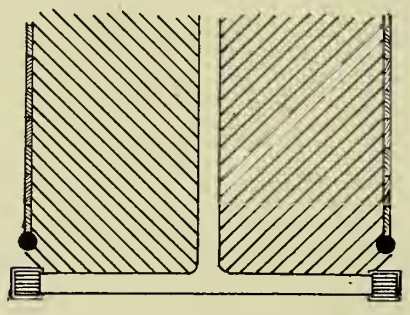


Fig. 23.

the passage level. This will allow of the cow's droppings falling into an open gutter and not fouling its bed in any way. However, in the case of Jerseys this would scarcely answer, as they have a habit of pulling themselves forward into their stall. Therefore the peculiar habits of the breed of cow must be studied. Some authorities are of opinion that a softer substance is required at the head of the stall than paving bricks, as the cow requires a warm and more yielding substance to kneel upon, and that it would be better to provide a space levelled with well-rammed clayey earth.

Drainage.

With regard to the drainage proper, the client may have his special fancy as to whether he will have it on

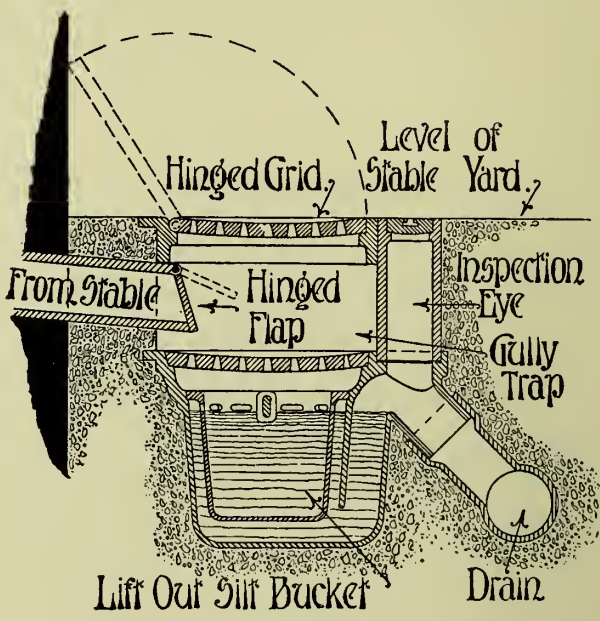


Fig. 24.

the surface or underground. It really matters little so long as the systems are efficiently laid. If underground drains are used a horse-pot of some description is necessary, of which that shown in Fig. 22 is a good example, with bucket to receive solids, and inspection eye quite apart from trap itself. The drainage from one or more stalls (Fig. 23) is conducted by a channel to this pot, whence it goes to an inspection pit or special trap outside. A special drain-pot for outside purposes (Fig. 24) is made by Messrs. Young & Co. It is intended chiefly for systems where all inside drain-pots are dispensed with. The illus-

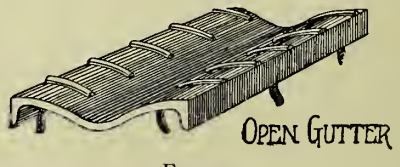


Fig. 25.

tration practically explains itself. Inspection to stable gutter is obtained without removing the bucket, as is also inspection to main drain. The laws of ventilation should be applied as for house drainage, and a foul-air shaft provided where an inspection pit is used (see Volume II.).

The channel used to lead to the horse-pot or direct to outside trap may be entirely open, such as that made by the St. Pancras Ironwork Company (Fig. 25), which is made of wrought iron and is firmly fixed into

the concrete bed by means of the lugs underneath. These open channels may be used in conjunction with horse-pots, or they may be carried as surface drains till they reach the exterior wall of stable, through which an opening has to be made, protected by a flap valve; and here the contents are discharged over an open pit or trap. In many cases the drainage channels, whether in connection with horse-pots or not, are covered over with a perforated grating, the cover being easily taken off for cleansing purposes, and

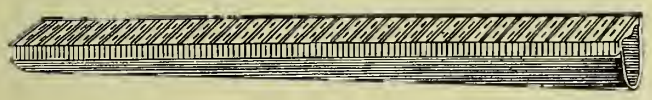


Fig. 26.

put on so as to afford a level walk and at the same time satisfactorily hiding all drainage. Fig. 26 shows a channel which is so made that sufficient fall is given to take away urine, whilst at the same time allowing the stall to be kept almost level, the only fall being from each side towards the gutter in the centre. This is a decided advantage. These channel gutters, whether open or otherwise, are run to about 4 feet from stall head, unless water is supplied to and wasted from the water feeding pot—when the channel should be continued to receive waste pipes, which will prove effective in swilling the channel. Fig. 27 shows a cast-iron perforated cover top to a concrete or brick channel as made by Messrs. Musgrave & Co. The wrought-iron pieces which carry the cover are firmly bedded in the concrete. Another form is shown in Fig. 28. In loose-boxes, where horse-pots are used, it is customary to place them in the centre and to drain the floor towards them, as shown in Fig. 29, or these channels may be placed anglewise as desired.

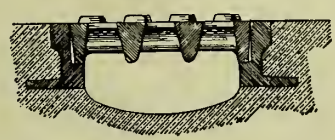


Fig. 27.

Manure.

The manure is removed from stables where horses or dairy cows are kept and stacked in a heap, which should be covered and so protected from the rain whilst allowing a current of air to pass over it. The floor should be of good solid and smooth concrete, slightly sloped towards collecting grids, to which all the dark coloured manure liquid will find its way, and thence through pipes to a cistern to which is fixed a good-sized pump. Where cattle is kept for fattening purposes the manure is left to accumulate for several weeks before being removed; in this case a great deal of the liquid becomes lost, and provision need not be made for its collection. There should be separate heaps for horses and cattle.

Horse Stables.

Horses are housed in as comfortable a manner as possible, but the opinions of the owners are many and varied, and these should, above all things, be carefully studied. The loose-box of 12 by 12 feet or 12 by 10 feet is naturally the best way of housing a horse, but in most stables sufficient space is unobtainable, so stalls are provided instead; that is, spaces which should

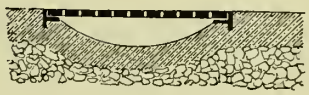


Fig. 28.

be 6 feet to 6 feet 6 inches wide (although many are put up as narrow as 5 feet 6 inches), and about 12 feet long to the gutter. Between each horse is placed a division. Iron is claimed to be the best and strongest material for the framework, but wood is preferred by many as being quite satisfactory and easily repaired *in situ*, which is a great consideration in stables removed at a distance from any large town.

Fig. 30 shows a 4-inch square — 6 by 5 inches or 5 by 4 inches—oak post firmly fixed to ceiling joists, and into concrete below. From this is carried the ramp, or sloping rail, from post to wall, where it may be built in or fixed to a second post. A strong piece or sill should run along the floor, and both this and the ramp grooved to receive 2-inch wood boarding

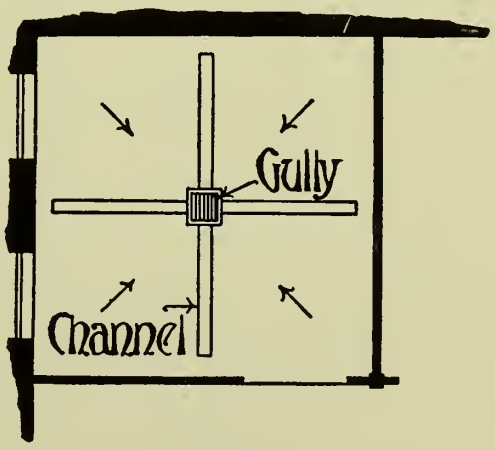


Fig. 29.

secured together by means of an iron tongue between the boards. A ramp of 6 by 5 inches can also be used with a lower rail, 7 by 1½ inches, to which 1¼-inch sheeting is nailed on each side, which is kept raised 1 or 2 inches above the floor for purposes of ventilation.

Where economy of money and space has to be considered, or where temporary stables have to be erected, an arrangement shown in Fig. 31 may be adopted,

which consists of a plank of wood, technically known as a bale, some 15 inches deep, hooked to the wall, and suspended by a chain to the ceiling joist. This arrangement is much used in military, tramway, and other stables where a great number of horses are housed. It may

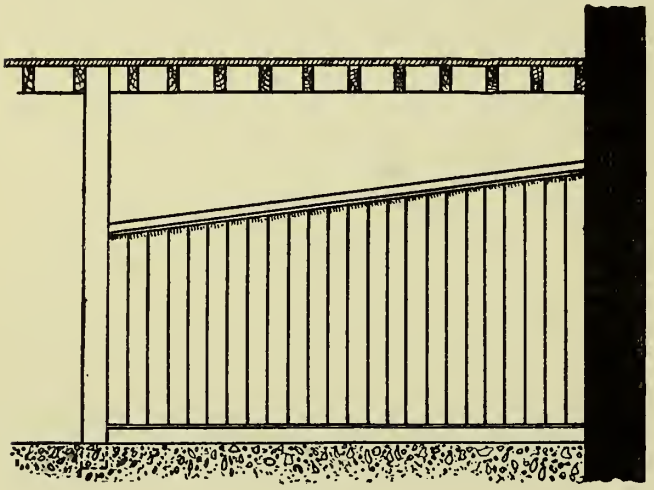


Fig. 30.

also be employed for dividing a loose-box into two stalls. A pole may be substituted for the plank, an arrangement which is commonly used for troop horses.

In most stables of any pretension iron posts, ramps, and sills are used. The post may be carried from floor to ceiling, making a solid abutment for the ramp, as also helping to carry the floor above. In Fig. 32 it is shown simply as a heel-post, and this is what most commonly occurs. The post varies in diameter from

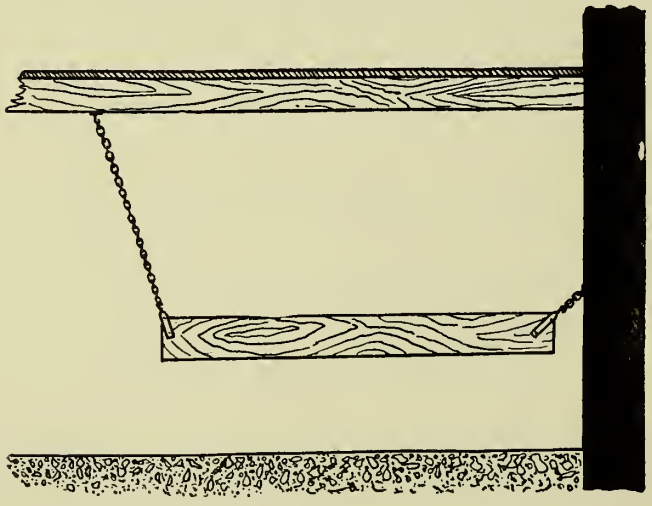


Fig. 31.

4 to 6 inches, according to the strength required, and is of wrought or cast iron. Posts are also made of oval shape, the idea being that the projection beyond wood panelling is less. A post of similar design to the heel post, but halved and of greater height, may be fixed at the head or wall end of stall, and so give an effective finish to the stable.

As the strength of the stall depends almost entirely on the solidity of the heel post the mode of fixing it is important. Fig. 33 shows a special base for fitting into

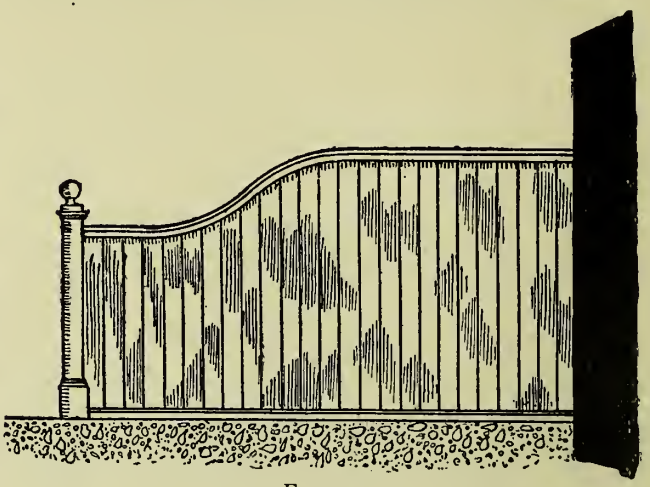
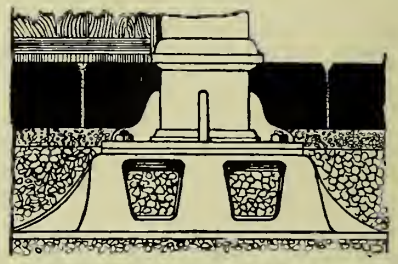


Fig. 32.

concrete, which renders the post quite firm, or the post may be fixed to stone bases by means of lewis bolts. The sill piece is frequently made of grooved iron to



Improved Self-Fixing Base

Fig. 33.

receive the boarding, a shifting piece being provided, so that a broken board may be easily replaced, or the sill may be laid flush with floor or raised some 3 to 4

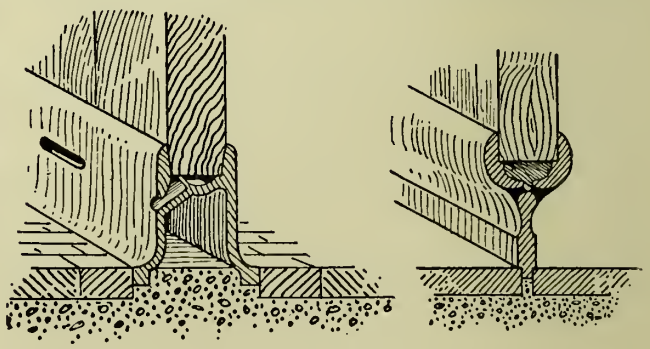


Fig. 34.

inches, to allow of ventilation below. The length from head to heel is 9 to 10 feet.

Fig. 34 shows two forms of sills made by Messrs. Musgrave & Co., which allow of ventilation about the

ends of boards and of free exit of moisture, thus preserving the boarding.

Fig. 35 shows another means of ventilation by the same makers, advantage being taken of the cavity inside the heel post, having air admitted into it by means of an air duct leading to the outside wall. The air enters the stable at the top of post.

A ventilating stall division, made by the same firm, is shown in Fig. 36. As will be seen, the air enters the hollow division through a grating close to floor level, and is admitted to the stable at top of the ramp. This air trunk is fitted with a regulator.

The ramp, or top iron bar of the stall division, may be of almost any shape or contour desired, and is grooved to receive the boarding, if such be carried up to the top, or else to receive moulded iron bars or open grating. It should be at least 7 feet high at head, and may run horizontally to heel post, so obscuring one horse from another if the boarding is carried right to the top. The ramp may fall in a straight line, or curve in a sweep to some 4 feet or 4 feet 6 inches at the heel.

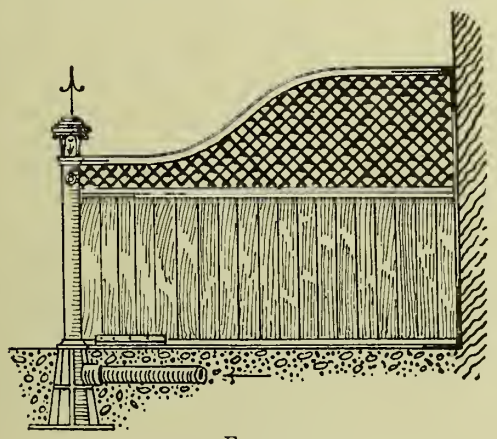


Fig. 35.

At some 3 feet 9 inches to 4 feet 6 inches from the floor a middle rail may be inserted (see Figs. 35 and 36), and the space between this and top rail be filled up with some plain wrought-iron bars or with some cast-iron pattern. It is a matter of opinion whether the division at the head end of the stall should be left open or closed, many being of opinion that horses can eat more comfortably if not interrupted by seeing one another. It can be filled in with sheet iron if so desired.

A complete finish to the stable is obtained by fixing a half-post and lining against the wall which forms the side to the stalls at each end of the range.

The panelling itself should be of strong wood, such as oak or pitch-pine, and of $1\frac{1}{2}$, 2, or $2\frac{1}{2}$ inches thickness, according to the strength of the horses to be provided for. The generally accepted method is to fix the boarding vertically, but it is sometimes preferred that the boards should run horizontally, in which case they should be secured at head of stall into a channel iron made for the purpose. A strong form of division is one in which two layers of sheeting are used, laid vertically on one side and horizontally on the other.

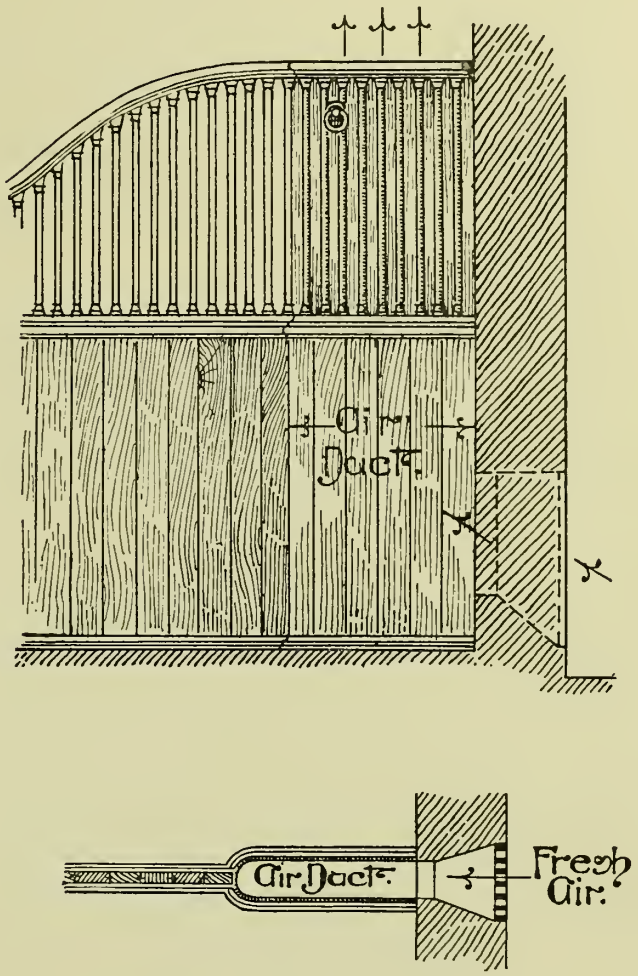


Fig. 36.

Should horses break loose they would be at liberty to roam where fancy took them. To avoid this, which might prove dangerous, especially if it occurred at night-time, drawbars (Fig. 37), one or two in number,

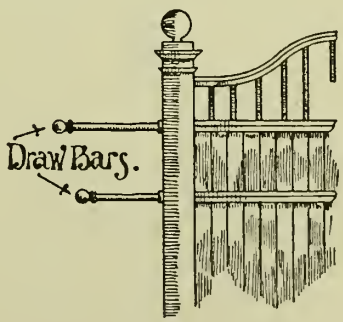


Fig. 37.

are provided, which slide into hollow bars used as middle rails in the stall divisions, and drop into a slot flush with the wall, so completely enclosing the horse in his stall. Fig. 38 gives an illustration of an iron

framework division filled in with glazed brick instead of wood, and finished with cement. This would be easily kept clean, but would probably suffer much from a kicking horse.

To protect the wood at foot of stall, special mats or corrugated indiarubber buffers are sometimes provided and fixed to the boarding.

Fittings used for loose-boxes should follow in design those used for stall divisions. The top rail, however, should be kept horizontal, whilst the middle rail might

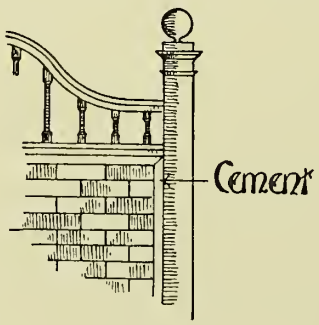


Fig. 38.

be lower on the passage side. In any case the ventilating panel in the door could with advantage be kept lower, so that the groom might have an easy view of the inside of the box. The door should be at least 3 feet 8 inches wide, and may be made to slide, swing, or open outwards, the last being the most usual. As has been said already, a loose-box is at least 10 feet wide and 12 feet or more long. Tired or sick horses are placed in them, and where hunters and racing horses are kept they are provided each with its own loose-box.

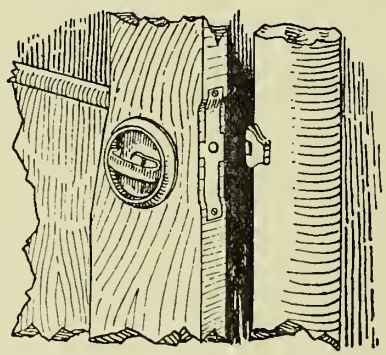


Fig. 39.

These loose-boxes form a range of their own, or are in conjunction with stalls. In the former case the doors would open in front of the box, and in the latter would probably be placed at an angle of 45 degrees, one of the angle posts thus serving the purpose of heel post to the stall division. A sick-box should, correctly speaking, have no connection with the stable, but should be kept apart, so as to give the occupant complete quietness; and whenever possible it is desirable that this should be done.

A point to be considered in connection with loose-boxes is the means of latching the door in such a manner that it will not open to any amount of "nosing" from the horse inside, and yet may be easily worked by the attendant outside; whilst at the same time,—like everything in the stable,—it should give as little projection as possible which would tend to injure or annoy the horse. Fig. 39 shows a latch made by the St. Pancras Ironwork Company, which appears to fulfil the conditions required, as it is perfectly flush when open; but on the door closing the latch automatically enters the striking plate, and can only be opened by the handle on the outside.

Many devices have been designed for converting two stalls into a loose-box, and *vice versâ*. They all leave something to be desired, but still are useful fittings

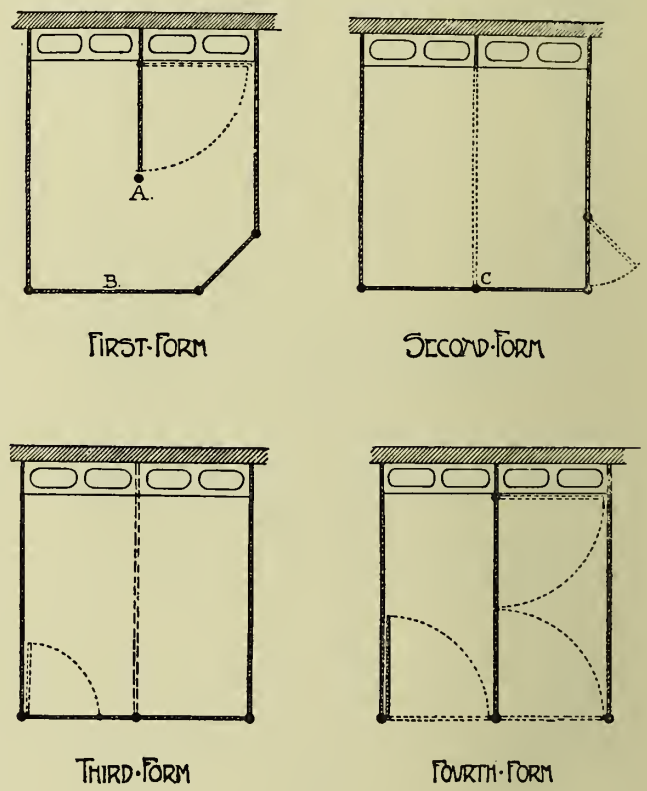


Fig. 40.

where no loose-box is provided for, as is the case in many stable buildings. Fig. 40 shows various forms, firstly, where the heel post *a* is movable and the partition swings back against manger, thus forming a useless space. The partition *b* is a fixture with its post and door.

In the second case, post *c* turns in slots at top and bottom, and the dividing partition slides through and forms a loose-box, the door to which is found in the right-hand side division. This would be only convenient where there is passage space on to which the door might open. When the door would more conveniently open on the front, the third scheme may be adopted, when, for conversion into stalls, the door is hinged back against the division, as shown by dotted lines, and

the remainder is run through the groove of post. The fourth scheme, adopted by Messrs. Musgrave & Co., is one where the various portions of panelling are hinged to the iron posts, and revolve into the positions for which they are needed, as indicated by dotted lines.

The mangers or feeding places are now usually made of iron, but in some country places it is still preferred to construct them of wood, with a piece of hoop iron fixed over the front edge to prevent what is known as

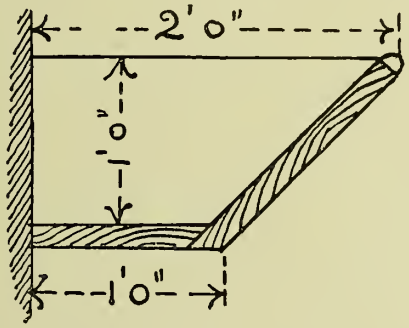


Fig. 41.

crib-biting. Wood is said to convey infection from one horse to another. Fig. 41 gives a section of such a manger made of 2-inch oak with round edges, and is 2 feet wide and 1 foot deep. The mangers are carried the full width across head of stall, being divided into one, two, or three compartments, with or without a hay-rack. A single pan manger is shown in Fig. 42, fitted with two bars on which revolve rollers to prevent the food being tossed out. These are used for cart

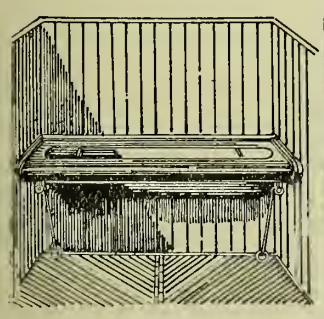


Fig. 42.

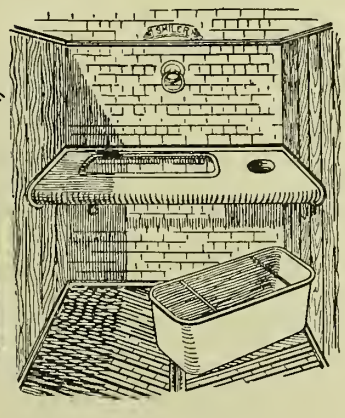


Fig. 43.

horses, as are also mangers of cast-iron framework with movable pans of galvanised steel (Fig. 43).

The latter offer a great advantage where many horses are kept and where as little time as possible is disposed to the cleaning of their stalls. The attendant may take a number of these portable mangers to the washing place, and swill them out in very little time. These one-division mangers are useful where the food is served all chopped up in a mash. The small circular pan is for the reception of rock salt, which keeps the horse interested by turning it over and licking it, so arresting any tendency which he might otherwise have to crib-biting. It must be borne in mind that horses of a heavy type, such as those used in brewer's drays, etc., require fittings of greater capacity and strength than do those who do less work, and that of a lighter description. For these latter are provided manger fittings such as those in Fig. 44, which has—as also other mangers of similar description—a rounded nosing, so avoiding any sharp and injurious edge. It is divided into three compartments: a manger trough, water pot, and hay-rack,

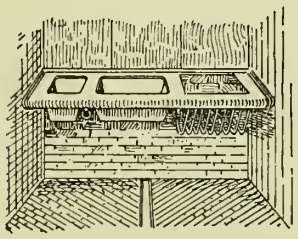


Fig. 44.

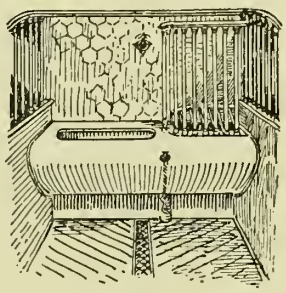


Fig. 45.

the inside width of which varies from 18 to 24 inches, the whole manger being placed at a height of 3 feet 3 inches to 3 feet 6 inches from floor. Mangers are also made in two compartments, leaving out the water trough. An improvement both in appearance and cleanliness is for the inside of water pot and manger trough to be enamelled. In most stables the horses are watered out of a bucket at fixed times; but where the water or gruel pot is part of the fitting it would be wise to go a step further and to lay on the water

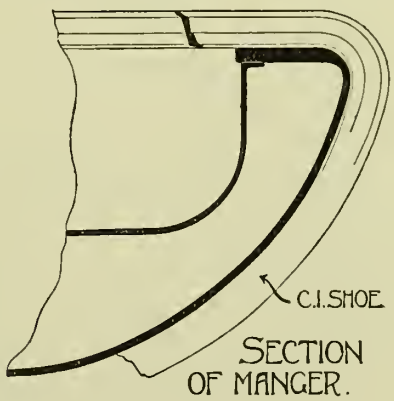


Fig. 46.

supply, and have a waste plug with lead or iron pipe leading to drain channel, which in such a case should be carried right up to wall, as in Figs. 44 and 45. The water container could with advantage be on the tip-up basin principle. Fig. 45 also shows another type of manger in which the hay-rack is placed above manger level. The grating shown at the bottom of the rack serves to keep the hay always well forward. A section of this manger and its protecting plate is also given in Fig. 46.

The fronts of mangers may be left exposed, protected

by a curved steel shield, as in Fig. 46, or else have wood sheeting from rim to floor level. This sheeting should be sufficiently raised to allow of passage of broom, etc., or else returned just below the fitting.

Loose-box fittings are much the same as those for stalls, with the exception that less space is encroached upon if the manger is placed anglewise, or if the hay-rack is placed in one corner and manger trough in the other.

Fig. 47, a registered arrangement of Messrs.

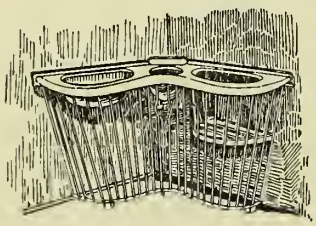


Fig. 47.

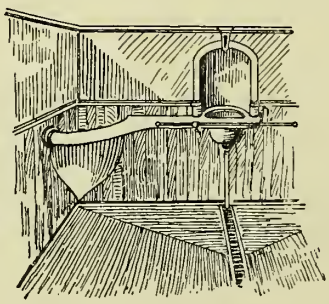


Fig. 48.

Hayward Bros. & Eckstein, shows what is termed a ventilating guard. This prevents the horse injuring himself, and at the same time avoids what, in the above-mentioned cases, is liable to become a receptacle for dust, etc.

Messrs. Musgrave & Co. have an arrangement made of iron (Fig. 48) which may be used for loose-box or stall, while it has the strength of an ordinary manger, and economises space. A water pot is shown recessed in the wall, the use of which is optional.

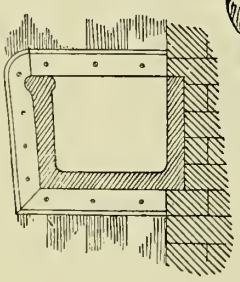


Fig. 49.

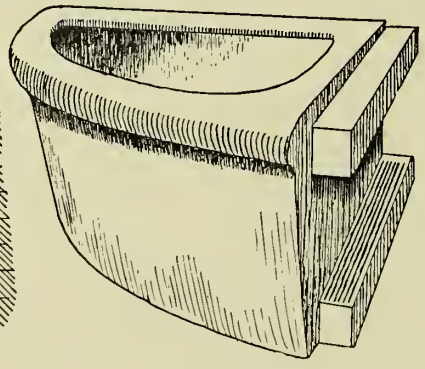


Fig. 50.

If a hay-rack be made flush with manger it is wise to dispense with any iron rim at back or side, as this might annoy or even entrap the horse should he get his head sufficiently far down.

Messrs. Oates & Green manufacture mangers in salt glazed ware which recommend themselves on account of their cleanly and sanitary properties. They are made in what is called "Nalethric" fireclay, and are highly glazed; they may be had in brown colour, cream, white, or light green, enamelled inside or outside. Iron is used as brackets for fixing to the wall, and also for the hay-rack. Fig. 49 shows one of the mangers in section attached by means of wooden cleats, and built into the wall flush; but many other means of fixing are adopted, such as by iron plates or bars or by a pillar support. The overall dimensions are 18 inches wide and 13 inches deep, length varying from 3 feet to 6 feet 6 inches.

Fig. 50 shows the general appearance of such a fireclay trough. This special one is made for a loose-box, and is fitted with lugs to fix into walls, instead of which they may be obtained with eyelet pieces to enable of their being bolted to wall.

For a loose-box which is convertible into two stalls, two manger sets should be provided, or a set with a centre and common hay division, as in Fig. 51.

To prevent crib-biting, Professor Varnel invented movable mangers such as that in Fig. 52, which close flush with wall. To accomplish this a space must be allowed at back of stall, which in the majority of cases would be inconvenient, except where a central feeding

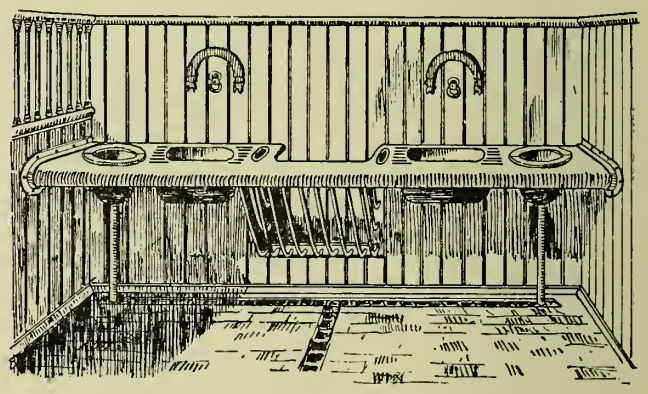


Fig. 51.

passage is used in the same way as used in cow-houses. Angle fittings are also made to close up flush, the inside of stall having to be fitted with a wooden shutter which covers up the manger opening.

The usual method of fastening a horse is from the centre of manger, but it may be accomplished equally well from one side or both, it being deemed advisable in some cases to tie the horse on both sides, so keeping him straighter, with less likelihood to disarrange his grooming before going out. The old method is to merely tie the horse to a ring, but some more suitable arrangement may easily be found. Fig. 53 shows a chain or leather strap which runs through a ring and over a pulley, and is attached to a weight which slides along a guide bar. This same principle as the above, but for cheaper stables, can be applied as in Fig. 54, where the ring slides up an inclined bar. In good stable fittings the weight and leather strap are enclosed in an iron casing and work perfectly noiselessly.

A brass ring is often fitted at head of stall, and this may be combined with the ornamental name-plate which it will be necessary to provide in a stable

built for a gentleman's requirements. For loose-box, rings may be provided, but the most usual thing is a ring sliding on a horizontal iron bar (see Fig. 48). This serves the purpose of preventing the horse lying down after having been groomed.

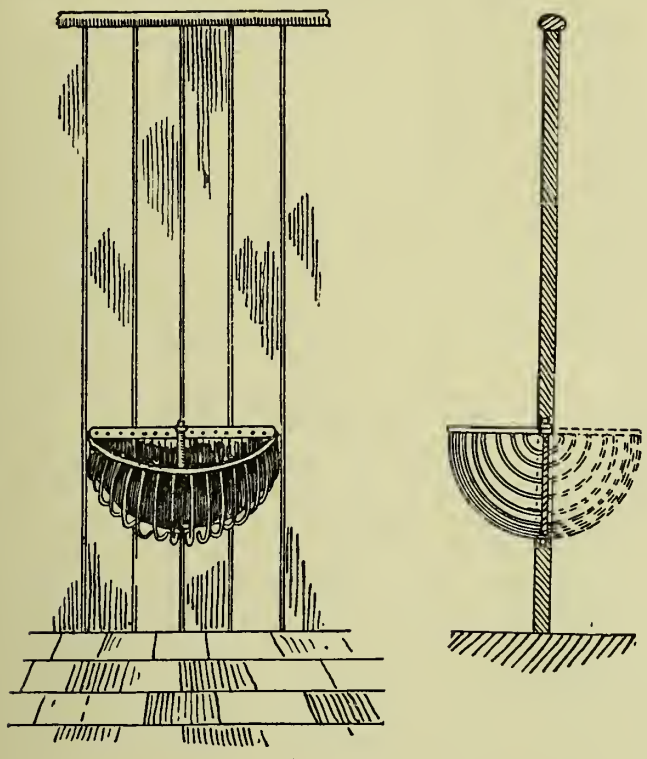


Fig. 52.

In stables for tramway, brewer's horses, etc., brackets for carrying harness are fixed on to the heel post. In other small stables the harness is hung on iron or wooden hooks (Fig. 55) fitted to a board fixed to the wall. A good and inexpensive form of

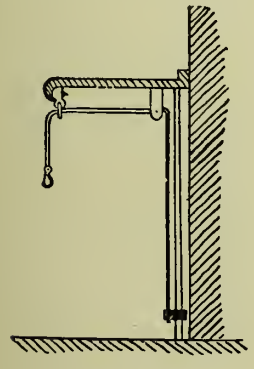


Fig. 53.

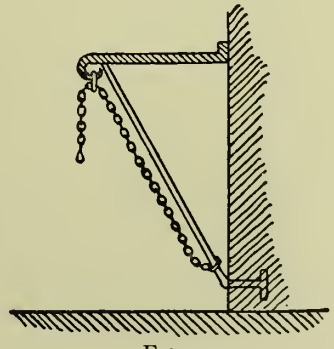


Fig. 54.

bracket is a wooden peg on which two pieces of wood are placed saddle ways (Fig. 55).

Harness, to be kept clean and uninjured, should be placed in a room apart. In large stables where private carriage horses are kept the cleaning of leather, brass, and plate forms a considerable portion of a groom's day duty, and so a room of size in proportion to the size of the stable is essential. The various brackets are made of malleable iron, which is japanned, galvanised, or enamelled, or may be capped with polished wood.

A riding outfit would consist of a gentleman's or

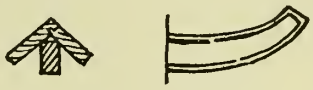


Fig. 55.

lady's saddle bracket (Fig. 56), and of stirrup bracket, girth bracket, bridle bracket (Fig. 57). The whole set may be arranged one above the other, and would thus occupy a wall space of 7 feet 3 inches from floor by 2 feet wide.

Driving harness for a single horse is composed of pad, collar, rein, bridle, and crupper brackets, which

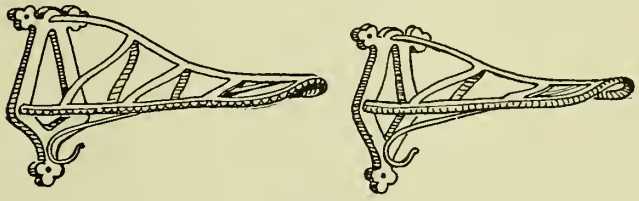


Fig. 56.

may be arranged as shown in Fig. 58, the top bracket being fixed 8 feet from floor level; and in the case of single harness 2 feet wide, and for double harness—when the above brackets are duplicated—4 feet wide.

To better preserve harness from dust and damp, glazed cases can with advantage be used. The

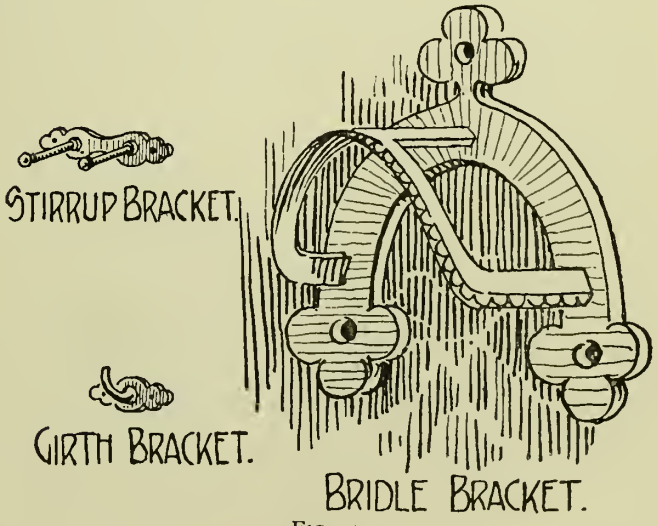


Fig. 57.

amount of harness to be put away will regulate their size. Bits and curbs are also placed in a glass case of their own.

Brackets or shelves should be provided for lamps, as also racks for forks and brooms carried by double hooks; and a cupboard for brushes, etc., is also necessary.

Whips may be carried on a circular wheel holder fixed to wall, or may simply be placed in a movable stand. Figs. 59 and 60 represent girth stretcher and saddle airer respectively, which are essential to a well ordered stable.

For cleaning purposes, hooks (Fig. 61) are fixed to ceiling, and are made telescopic and to revolve.

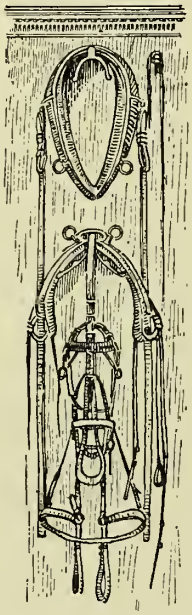


Fig. 58.

Tables fitted with cupboards or drawers for the storage of rugs, saddle-cloths, etc., form part of the establishment, and can be made with saddle-shaped tops for cleaning harness. Such tops may be formed of folding flaps, which can fall to the sides or be folded flat and used as ordinary tables.

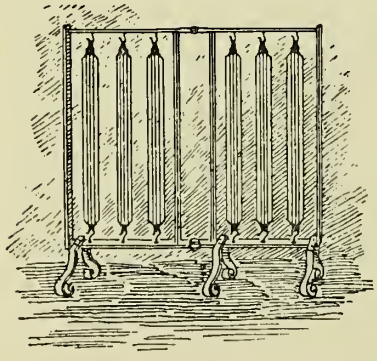


Fig. 59.

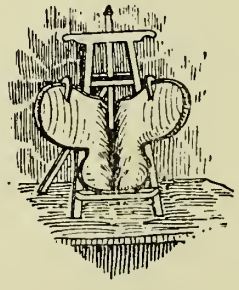


Fig. 60.

In stables of small size the oats, wheat, etc., are kept in the stable in oak, wrought-iron, or galvanised iron bins.

Meters are useful when a check has to be kept on the supply which is fed from the loft above. A shaft for chopped hay, constructed of wood, may be also fixed in a suitable corner. Fig. 62 shows an arrangement which consists of a wooden shaft 3 by 2 feet or larger, the top of which may be level with floor of loft, or preferably be fed by a hopper. The food stuff then falls on to the planking fixed at a gentle slope, and passes to the other sloped boarding. Below this is a drawer which, when opened, has the food admitted into it by means of a vertically balanced shutter sliding up and down.

It is an advantage to place this feeding shoot in such a position that it will be possible to place the chaff cutter directly above the opening at top, so saving the intermediate handling.

Instead of having the sloped slats as in Fig. 62, the shoot may be quite open and the food be taken out by hand on the raising of the shutter. In this case a lower door should be provided to allow of cleaning. Machines are used for crushing oats and beans and

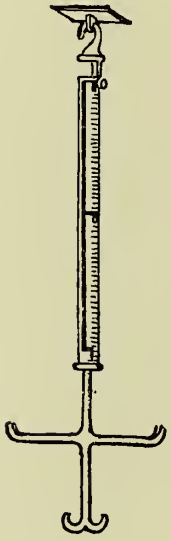


Fig. 61.

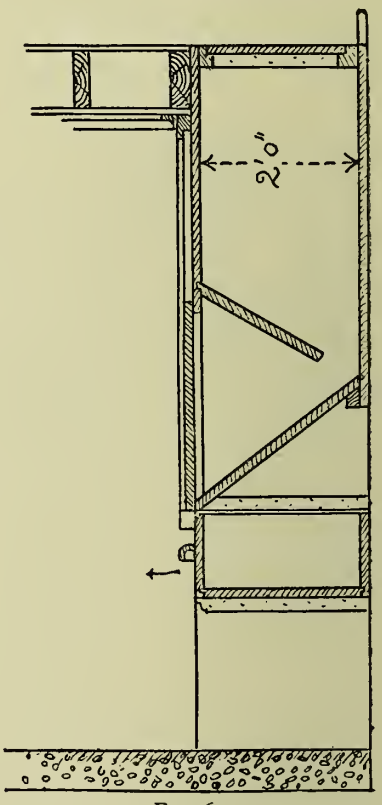


Fig. 62.

for grinding corn, and these would most conveniently be fed by large hoppers, into which the grain is placed as required. After going through the machines it is received into sacks, and then transferred to bins or to the feeding shoot or metal box, if such is in use. The above process would only be possible where the building was of two storeys in height, with a loft above the stable. Each case has, however, to be met in the most suitable way, provision being made for fixed or running beams to carry any necessary tackle for hoisting purposes.

In mixed farms, where pigs and cattle are kept as well as horses, pulpers for cutting roots or green stuffs are used, and are often placed on the first floor. They should empty into a shoot, placed preferably—if

situation so allows—at a gradual slope, so preventing the cut stuff, such as greens, from being unnecessarily pressed together. Trolleys are used to carry the mixed foods for pigs, etc. Outside the stable building a cattle watering trough should be built up of brickwork cemented over, to which water should be connected, and waste pipe and plug provided. In some instances, where this trough is placed in a cool and sheltered spot, as should always be the case, farmers place pails of milk in it to cool, changing the water at intervals. A wood frame with mesh wire, let down over the top and tilted at an angle, forms an effective protection.

When stock yards are in common use the method of watering is by means of wooden troughs, such as that shown in Fig. 63, carried by means of cast or wrought-iron standards.

Cow Stables

The method of housing cattle differs in various parts of the country. Some farmers place the cows without any division between them; others give them each a stall; whilst others place them in pairs. The first plan has nothing to recommend it except cheapness, and even this is doubtful, as the benefit the cow would derive from extra comfort would probably amply repay all initial outlay. The second plan is that adopted in the homes of the Jersey cattle—famous both for their beauty as well as for their dairy value—as the breeders maintain that these cows need and merit a stall apart. The last plan may be said to be that most generally adopted, and has been found perfectly satisfactory, as one cow of the pair becomes the master of the other and peace reigns between the two. To form a partial division, a hay-rack (Fig. 64), V-shaped in plan, having 2 feet 6 inches projection, forms a most economical arrangement.

Cattle may roughly be divided into two classes—those kept essentially for dairy purposes, in which case the stalls are frequently cleaned; those which are being fattened for the butcher. These latter are fed on roots, patent cake food, etc., and are either placed in a stockyard or in stables; but in both cases the manure is allowed to accumulate for several weeks at a time, as it thus becomes of greater value for placing on the land.

With the majority of farmers a rough concrete floor is the favourite material, as being easily repaired. Some are of opinion that the part of the floor on which the cow stands, commonly called the "standing," for some 2 feet distance away from the front of manger, should be composed of well hammered clay, as being less injurious to a kneeling cow. Other farmers maintain that this sinks or wears more rapidly than the rest of the standing, and that the increased attention required does not compensate the little injury which may happen to the cow. Again, as a cow does not as a rule foul her bed, the whole of the standing may be of well rammed clay, having a curb of stone, wood, or brick.

The general arrangements of a cow-house fitting consist of the standing room, dunging passage, feeding passage, manger, and gutter. These may be disposed of in three different ways, apart from considering the plan of a single or double row, to both of which they may be applied in a general way; but for the present purpose a house for a double set of cattle may be considered, as it is the plan most generally used.

The first and simplest arrangement is where the cows are placed with their heads to the wall, and a dunging passage at their tails, between the two sets. This plan dispenses with a feeding passage, but the addition of this constitutes the second arrangement, and can be easily accomplished by keeping the head of the stall away from the wall at a sufficient distance to allow of the passage being introduced, which extra space would be essential in the case of long-horned cattle. In the third arrangement the position of the cows is reversed.

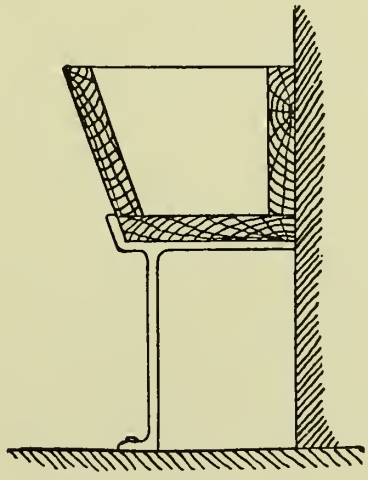


Fig. 63.

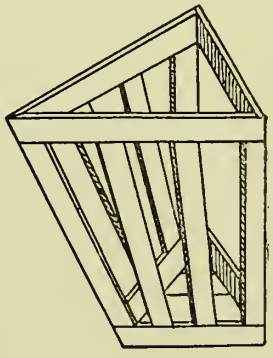


Fig. 64.

They face one another across the feeding passage which runs between them, whilst there are two dunging passages, one at the rear of each set of stalls. As the size of feeding passage is greater than that of dunging passage, this arrangement offers economy of space over the previous one. Where stables are used for show purposes a feeding passage is an absolute necessity. Again, the last arrangement is economical of labour, as dunging out only takes place once a day, whilst feeding occurs several times.

However this may be, the general dimensions may be applied as follows: Standing room (including manger) 7 feet or less, according to size of cattle. Feeding passage should be 6 feet, but is often less, though it could with advantage be increased to 8 feet. Dung channel 1 to 2 feet. Dunging passage 3 feet 6 inches to 4 feet, which is usual but rather cramped, and would be improved by making it 5 feet wide. It must be borne in mind that feeding and cleaning operations need a deal of elbow room and have often, if not always, to be performed when the cattle are indoors.

In the feeding passage are often placed a pair of tram lines, on which a truck is run for conveying the food to the various stalls; this arrangement is a valuable economiser of time and labour in a large stable, more especially if the food store is at some considerable distance from the cow-house.

The dunging channel may be made circular in shape, which however is not to be recommended, as being of insufficient capacity and offering a slippery surface. The more common shape is square cornered, of from 1 to 2 feet in width, to allow of free use of shovel, and 3 to 5 inches in depth. Fig. 65 gives a shape of channel which affords greater facility of drainage for the manure liquid than does the perfectly square channel by giving a sectional slope of 1 to 2 inches.

The floor of stalls should be very slightly sloped, 1 inch being sufficient, and in some cases it is preferred

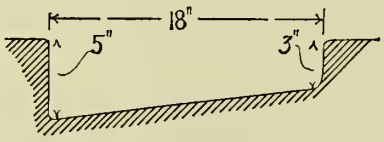


Fig. 65.

to keep it level and to raise it some 4 to 5 inches above the dunging passage behind. The dunging channel or gutter is made open, and carries the fluid either to cesspit or direct to the liquid manure cistern.

As to the stalls themselves, for one cow a space of 4 feet to 4 feet 6 inches is required, and 6 feet 6 inches to 8 feet for a pair, the length of the division varying from 4 feet 6 inches to 5 feet 6 inches according to size of cow, room being left so that milking operations can be easily performed. It may here be noted that a cow, in repose, lies over on its side, and therefore requires more room than the mere width of its body.

As in the case of horse stables, wood has a great deal in its favour by reason of its economy and easy

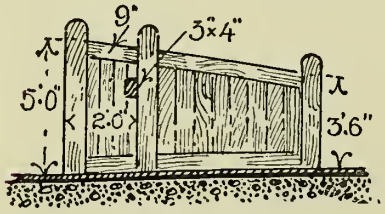


Fig. 66.

Fig. 67.

repair. Fig. 66 shows a division constructed of strong hard-wood posts, 6 by 4 inches, with ramp sloping 18 inches in its length. Between the head and intermediate post is placed the feeding manger, and the whole stall is rendered firm by a strengthening bar 3 by 4 inches fixed on the middle post, sufficiently high to allow of freedom to the cow when feeding, and at the same time preventing it from jumping over. The whole is lined on both sides with 1½-inch sheeting.

In this case the cattle can see one another across the passage. Should this be objected to a swinging shutter may be added, or a 9-inch brick wall built varying from 2 feet 6 inches to 3 feet high, capped by a square or splayed wood capping. The food is tipped over this into the manger bins below (Fig. 67).

Another form of division adopted by many farmers, and recommended by the Department of Agriculture and Technical Instruction for Ireland for its cleanliness

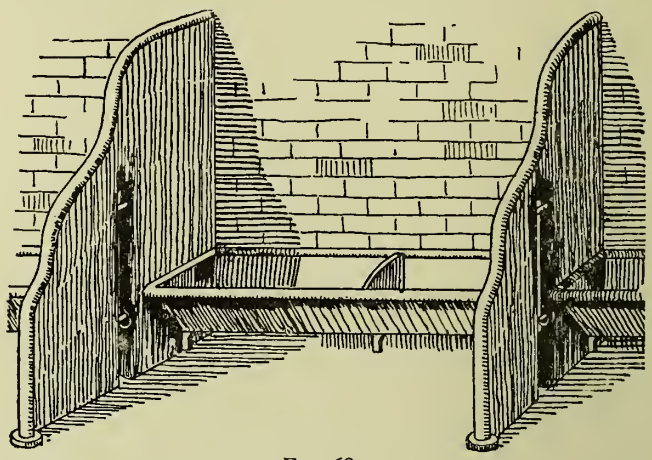


Fig. 68.

as compared to wood, is made of concrete, 4 inches thick and let 3 inches into the wall, whilst holes are to be left for the bolts, which secure the iron plates for chain attachment.

Stall divisions may be also made of slate in one slab, but these would appear to be breakable. Fig. 68 shows a division composed of iron ramp post and sheeting, all cast in one piece and so forming a solid and permanent fixture. When the

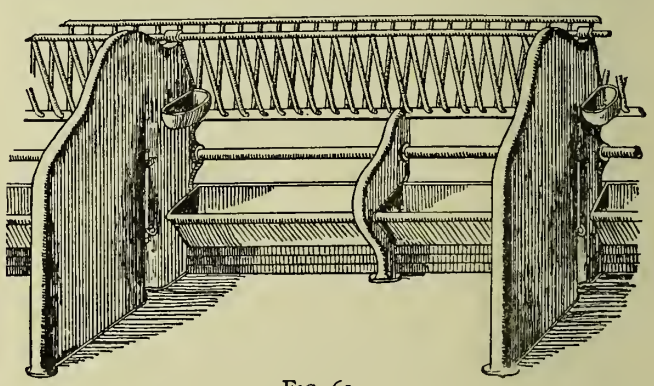


Fig. 69.

division is required for a feeding passage a form such as that in Fig. 69 is used, where one or more iron bars impart both strength to the fitting and a barrier against the cattle. Care should be taken that this iron bar stands sufficiently clear of the manger to allow of a basket of food being easily tipped, whilst at the same time not endangering the cow in its feeding on the other side. To this bar may be attached an iron swing shutter, which allows of the attendant depositing the food and prevents the occupant of the stall from being disturbed at the sight of the cow on

the other side of passage. Divisions may also be composed of cast-iron heel post ramp and sill—such as is provided in the horse stable, with the exception that the heel post is usually made tapering in its height from 6 inches at base to 5 inches at top. The division is filled in with wood boarding.

The feeding of cattle varies with different localities ; in some cases roots are given—which are now always crushed previous to eating and never given whole, as was customary years ago ; others prefer special cake food, whilst the hay may be chopped or given whole. In the latter case a hay-rack is required, whilst in the former case it is dispensed with. With a stall, the head of which abuts on to the wall, the rack consists of one set of bars only, whilst with a feeding passage

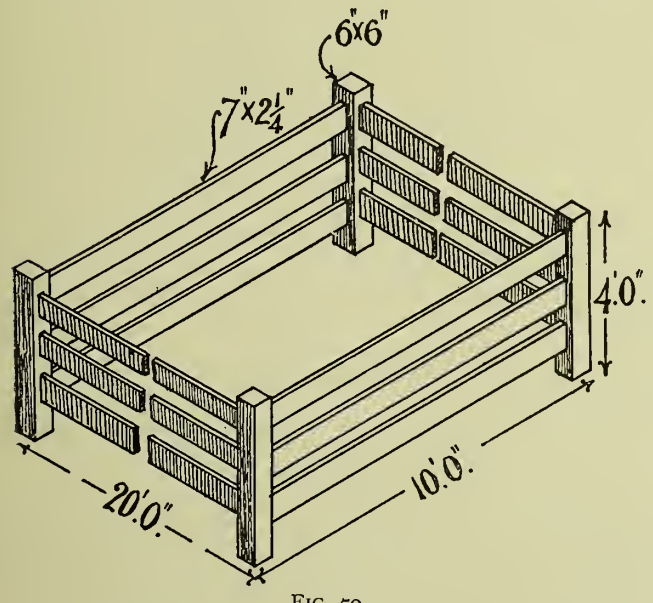


Fig. 70.

the rails will have to be duplicated as shown in Fig. 69.

For calf-houses the same remarks apply, except that the division would be of smaller dimensions—if, indeed, a division is used at all, as the calves are often placed in a row without any separation—and the hay-rack at a less height. A convenient rack for a range of calves —which are generally placed with their heads to the wall—is one made of iron framework with round iron bars, which can hinge back flat against the wall if not required for hay. A cow stall will often be used for young calves by boarding up the rear between the heel posts.

Bulls require a stall to themselves, and are usually secured on each side of division. If a concrete division be employed a useful arrangement is to fix a brick on end in top of coping with a cement head. As a bull often gets "out of hand," and is led by two men, this device or stud allows of one man giving a turn of the rope around this stud, so keeping the bull's head away from the other man who is attaching the rope. After this is accomplished the first man can attach his side without fear of receiving injury.

Where stock is kept for fattening purposes the arrangements are usually of a rough and ready method, the cattle being placed loose in empty houses, or in enclosed pens composed of a barricading of posts and lateral boards (Fig. 70) placed under an open shed. The sizes of pens and timbers is of no fixed standard, as these are generally knocked up by the farmer in the most suitable position, and with the wood at hand. Cattle are also allowed to be quite loose in the stock yards.

Mangers differ in various parts of the country. Some farmers maintain that the natural way of grazing is the best, and make the manger only some 6 inches high, with the interior of trough at the same level as the floor. In other places mangers are found 12 inches high, and in others as high as 18 inches, which forms what should be a maximum height. In any case the interior of manger would be of 6 inches depth. As the manger is at such a low level, and the food is sloppy and liquid, the use of wood is out of the question, but whatever material is preferred there should be every facility for cleanliness. A simple and useful manger is a half-round glazed stoneware

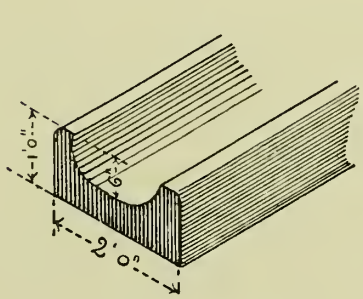


Fig. 71.

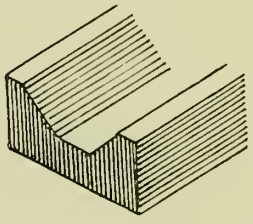


Fig. 72.

pipe bedded in concrete or brickwork. Concrete forms a favourite material for mangers which are from 1 foot 9 inches to 2 feet wide (Fig. 71), and of length to fit stall and height to suit local ideas. Mangers may be built of brickwork, grouted in cement, or again of stone which may be dished off in the manner shown in Fig. 72, with the slope returned at the ends.

The number of troughs to each cow is again a matter of opinion. In some instances the channel is continued all along the range of stalls, this being easily swilled and cleaned, an arrangement quite possible with concrete and pipe mangers, where a service water pipe can be fixed at one end and a waste pipe and plug at the other ; but the awkward part of a long length would be to obtain the required fall. In other farms two bins are provided to each cow, both for food (if the men have insufficient time to attend to cattle in their busy seasons), or one bin may be used for water. The most common system is to supply one trough apiece to each cow, with, in some instances, a central and common one to serve as a water tank,

which is, however, apt to become fouled with the splashing of the food from the adjoining bins, or from hay in the rack where such is used.

Sheet iron may be employed as a protection to water troughs, when it is bridged over by the hay-rack as shown in Fig. 73.

Feeding mangers are made of iron in several designs by the different makers. Fig. 74 illustrates the section of one made by the Carron Company, the back being kept

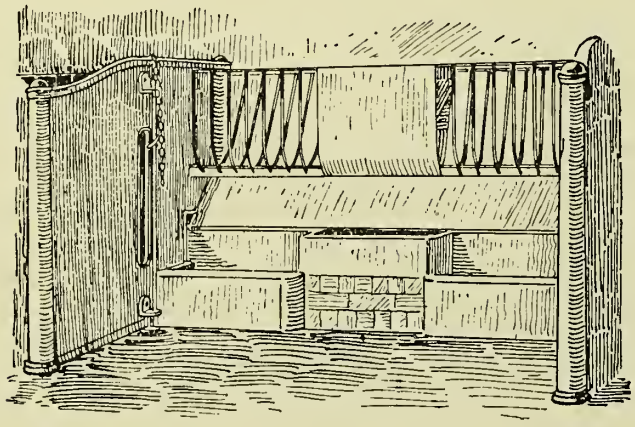


Fig. 73.

at a higher level than the front, so as to prevent the cow from nosing out the food. Cast-iron troughs are also made with flanges so that they may be bolted together, with a centre water pot bolted above the whole, being easily disconnected and removed for cleansing.

Messrs. Oates & Green make special manger troughs with their patent salt-glazed "Nalethric" fireclay of the following sizes: 24 by 17 by 10 inches, 30 by 17 by 10 inches, or 32 by 20 by 10 inches. Three of these may be placed together, as shown in Fig. 73, so that the two extreme ones rest on the floor and contain food, whilst the centre one, suitable for water, is raised on a platform of glazed brickwork.

With this combination an ingenious arrangement for the water supply is carried out under Smith's patent,

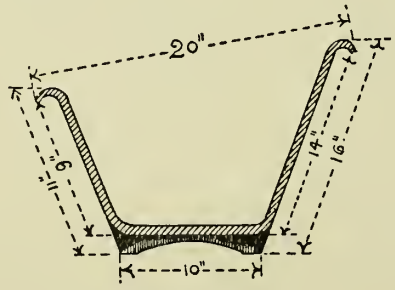


Fig. 74.

shown in plan and section in Fig. 75. The centre or water troughs are placed in communication with one another by a continuous channel, which is protected from any falling hay by means of the wrought-iron plate shown in section, the water trough being in its turn protected by the steel plate fitted to rack (*vide* Fig. 73). The width from front of manger to back of channel is 2 feet 2 inches.

The general mode of attaching a cow is by means of a rope, with a noose on one end, thrown over the neck

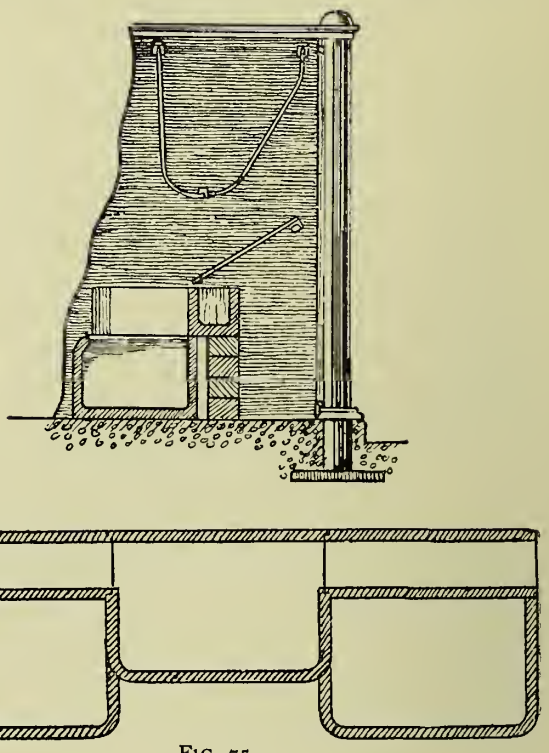


Fig. 75.

or fastened around the horns, and the other end fastened to a ring fixed to side of manger, or to a chain which is fixed to an iron rod bolted to the stall division. Fig. 76 shows a rod the top of which is

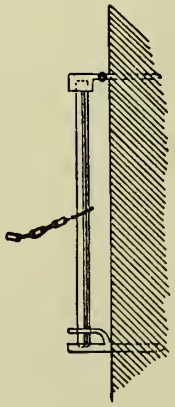


Fig. 76.

kept in its place by means of a hinged flap weight, whilst the lower end fits into a socket, and the chain attachment can be immediately released on the cover weight being raised and the rod drawn out of its socket.

Piggeries

According to the older system, an enclosed house and open yard are provided for pigs, whilst the tendency of the present day is to have several pens in an enclosed building. For growing pigs a run must be supplied. In the one case this is met by the foreyard; whilst in the other arrangement the pens may have their door opening into a common yard, or merely on to an enclosed plot of land which can serve the purpose of a stockyard or manure accumulating place. The floor of piggeries is made of concrete, except where the pig is fed on a whey mixture, in which case a hard brick is to be preferred, as the acidity of the whey quickly wears away the concrete. The drainage must be sloped away and conducted to an outside channel. Where a sleeping house is used, the floor is kept a few inches above the yard level. The fittings necessary are few, consisting almost exclusively of the feeding pans, which in some cases consist merely of round wooden tubs or stone troughs. Before dealing with these, however, it may be well to mention that where pens are used a raised platform, of some 4 to 5 inches high, is placed in one corner. This is composed of

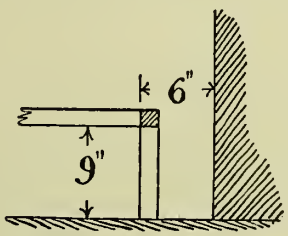


Fig. 77.

wooden bearers with battens nailed on, and spaced a few inches apart. For farrowing sows, protection must be made so that they will not overlay their young. This is done by placing a sloped board around pen or house, or by a rail and uprights, 6 inches away from the wall and 9 inches high (Fig. 77).

A corner of sow-house should be cut off by means of vertical boarding some 2 feet high, and the bottom part left open about 9 inches. This forms, for small pigs, a haven of refuge from an infuriated mother.

Where pig breeding is recognised to be worthy of attention, the pigs are fed regularly some three times a day in measured quantities, the food being conveyed in trucks or by hand. It is difficult to estimate how many pigs are placed in a pen or yard, some farmers being of opinion that two in a small pen is the ideal state, whilst others crowd some ten to twelve young pigs in a large sty, and in other districts the regular inhabitants number from four to six, according to their age. However this may be, each pig should have its own trough, as every diner has his own plate. The pig in its greed for food is not particular about keeping its feeding trough clean, therefore this should be so arranged and of such material that it can be easily cleaned, at least once a day, if not at every feed.

Where the piggeries are built of iron it will naturally follow that the troughs will be of the same material. For stone or brick-built styes the trough may be of any suitable material, being built of brick and cement, or

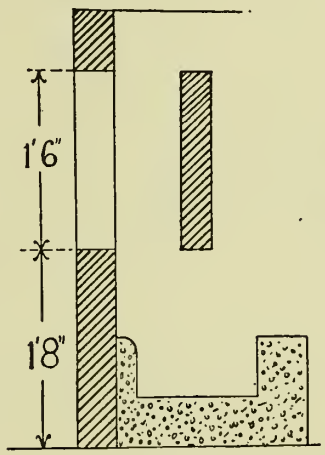


Fig. 78.

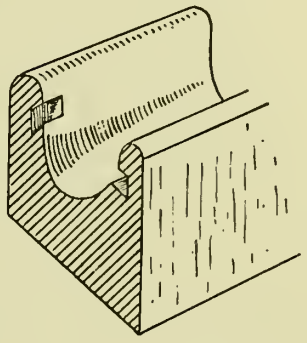


Fig. 79.

of concrete, stone, or iron. The troughs should be placed against an outside wall in the case of open yards, or against the division nearest the feeding passage where pens are used. A section is shown in Fig. 78, where the trough is of concrete 12 inches high by 2 feet wide, and a feeding hole is left in the front wall 2 feet wide by 1 foot 6 inches high. To prevent the food from splashing over the pigs, a stone screen is fixed across, carried by the end walls or dwarf intermediate partitions. Where whey is used for feeding, some hard brick is used, special channel troughs being made in the Staffordshire district, of which Fig. 79

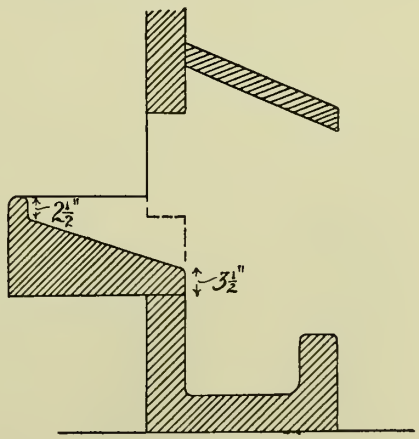


Fig. 80.

gives an illustration, 9 inches high, 12 inches long, and 18 inches wide, the clear space of channel being about 12 inches wide by 6 inches deep. At each end is a chase forming a key for cement grouting. In outside yards a canopy stone is often placed over the trough, as shown in Fig. 80, which protects the food from

being injured by the rain. A shoot is also used into

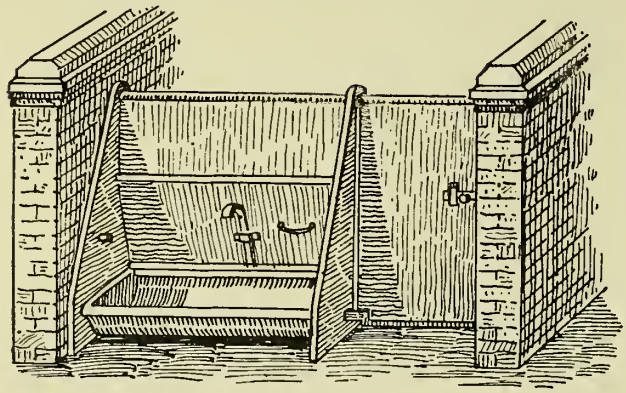


Fig. 81.

which the food is tipped. The whey, when used, is led direct, through service pipes, by gravitation or

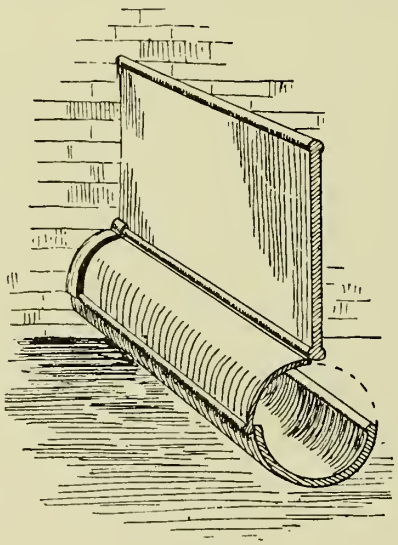


Fig. 82.

pumping action from the whey storage tank, and gets incorporated with the food in the trough.

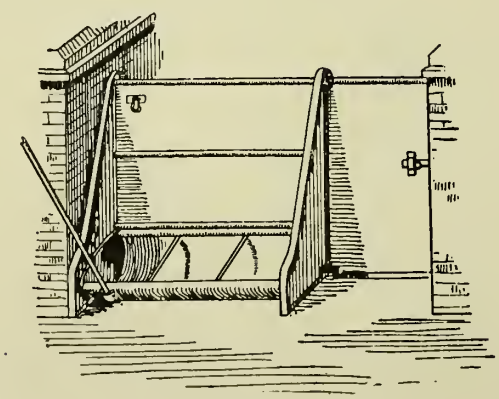


Fig. 83.

A shoot of this description, of Straffordshire brick, is shown in section in Fig. 80. It is 18 inches wide and projects 18 inches from front of wall, and has a rounded front and a height of 13 inches, which gives a fall of 7 inches.

The iron fittings are made so as to dispense with the

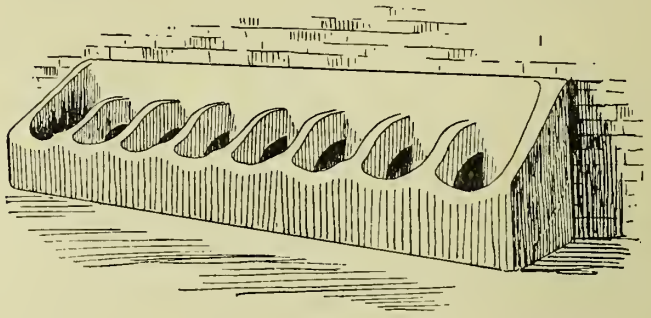


Fig. 84.

brickwork, although they can be built in conjunction with it. They consist of manger and top shield plate and supports, to which the door may be hinged if required. They are made on two different principles. In one the manger is made movable, and in the other it is a fixture, the mobile part being a shutter cut away from and hinged on to the top plate. The standard width is 4 feet between supports. Fig. 81 illustrates a

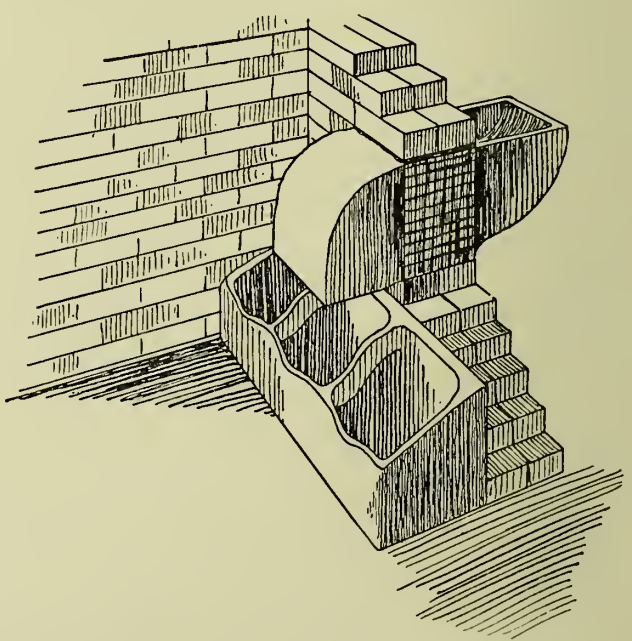


Fig. 85.

fitting where the trough is fixed to the shutters, hinged and fitted with a sliding plate latch so that it can be adjusted for feed or supply. It is shown open for the latter.

Another arrangement is to make the covering shutter revolving (Fig. 82), when it is of circular shape. In both cases the trough is closed to the pigs when the attendant is tipping the food. With a fixed partition the trough can be made to revolve

(Fig. 83) on its supports. The regulating movement is obtained by the long lever handle, which is detachable and removed when the pigs are feeding. Messrs. Oates & Green make pig troughs in their special clay, of brown colour, a row for small pigs containing 8 compartments (Fig. 84) being made 6 feet long. For grown pigs they are made larger, and in any number of holes.

A special shoot (Fig. 85) is also made in the same clay, which is a very neat arrangement, the food being dropped in on the outside, passing into the trough without any danger of overshooting.

CHAPTER VII

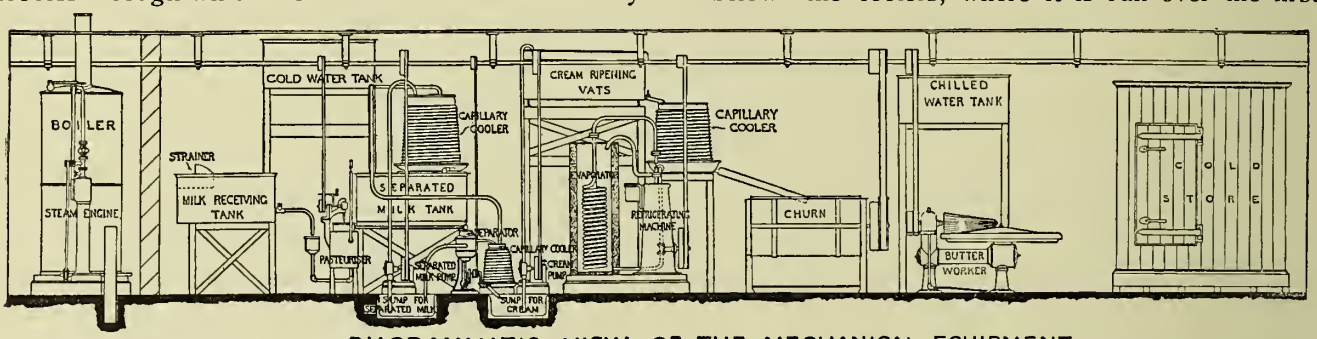
DAIRIES AND DAIRY FITTINGS

(*Contributed by* HEDLEY C. QUÉRÉE)

GREAT improvements and changes have taken place in dairy construction and fittings since the days when the cream was separated from the milk in a rough and ready method, and then placed in open pails to ripen till a sufficient quantity had been acquired to churn into butter.

Within the last few years all dairy appliances have been brought to a state of great perfection, both those worked by hand and those by machinery. The method of working both of these systems is practically similar.

By way of introduction it may be well to follow the process through which the milk is taken in an ordinary dairy of reasonable size. To render this general explanation quite clear, a diagrammatic view of a modern creamery is given in Fig. 86. The motive power is supplied by a boiler and engine, which are placed preferably in a room apart, and to which admittance should be obtained from outside, and not through the dairy.



DIAGRAMMATIC VIEW OF THE MECHANICAL EQUIPMENT OF A MODERN CREAMERY BY LOUDON M. DOUGLAS. A.M.I.MECH.E.

FIG. 86.

The milk when brought in is measured, tested, and, if found satisfactory, tipped into a tank on a raised platform, from which it flows into a *Pasteuriser*. At this stage of the process the purpose for which the milk is required has to be considered, whether to be sent out as milk or else to be turned into cream and butter. If for milk supply the milk is driven from the pasteuriser, where it has been heated, over capillary coolers, one cooled with cold water and the other chilled with brine; one cooler or both may be used as is required. The milk thus chilled flows down into a tank, from which it is drawn into cans used for the daily milk rounds. For butter making the pasteurised milk is run into a *Separator*, where the milk fat or cream is separated from the milk. That which is left is called skimmed milk, and is either run into a tank straight away, where it ferments, or else goes through to the intermediate stage of being chilled over a cooler. This milk is, as a rule, sold to farmers for feeding pigs, and it depends on their requirements whether the milk is to be chilled or not, but provision should always be made so that this may be done if required. The cream, when separated, falls over or is pumped up to—according as to whether the separator is above or below—the coolers, where it is run over the first one made cold by a supply of cold water, and then falls over one chilled with brine. The chilled cream is then either pumped into a cream ripening vat, or else drawn off in pails and placed in troughs to cool by means of cold water. When the cream has sufficiently ripened it is run over a cooler into the churn, or else placed into the churn direct, where it is rotated till it is of the consistency of butter granules, when it is taken out by hand and placed on the butter working table, is there kneaded and salted, and taken to an ordinary table where it is weighed and packed up. Here the actual making is at an end, and the butter is ready for sale. If to be stored, it is placed in a cool chamber or in a cold storage room. With modern churns and butter-workers every particle of milk fat is used for the butter, so that the liquid—known as butter milk—is of so poor a quality that it is usually run to waste.

Where it is required to have cream for selling purposes it is customary to place the milk, in pails,

into a concrete trough, where hot water is first of all turned on, so sterilising the milk, which is subsequently cooled by filling the trough with cold water. When the cream has sufficiently ripened it is cut off and sold, the remainder being sold as cheap milk, there being still a certain amount of fat in it. The width of trough will naturally be made to suit the size of whatever milk pail is in use by the dairyman for whom the dairy is to be constructed.

Washing troughs are an important point in dairies, and are made in number and size according to the peculiar requirements under consideration. Each trough should be in two compartments, one for washing out pails with cold water and the other for scalding with hot water.

It will be noticed that some of the principal requirements for dairy purposes are ventilation, cleanliness, and a very good supply of both cold and hot water.

Hand-Working Appliances

The Tanks (Fig. 87) may be here described, being both of same construction whether for small or large dairies, differing only in matter of size. For milk and cream purposes the following are required: The milk receiving tank, the separated milk tank, the milk supply tank for drinking purposes. They are made of

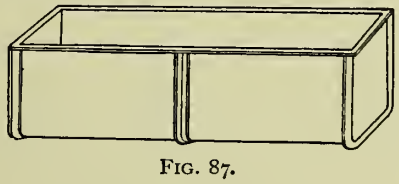


Fig. 87.

strong tinned steel or copper sheets. The following are stock sizes approximately :—

Gallons.	L.	W.	H.	Gallons.	L.	W.	H.
55	5.0	2.0	1.0	220	7.10	3.0	1.7
88	5.0	2.4	1.4	264	7.10	3.0	1.10
110	5.7	2.4	1.5	330	7.10	3.0	2.4
132	5.7	2.10	1.5	440	9.2	3.0	2.8
176	6.3	3.6	1.7				

The Pasteuriser has its own furnace, and is therefore heated independently of any boiler or steam-producing apparatus. A description of a pasteuriser driven by power will be found later on, and applies generally to all such apparatus. Burmeister & Wain's "Perfect" pasteuriser is capable of pasteurising milk or cream up to 190° or 195°. The sizes are as follow :—

Heating from	45° to 105° F.	45° to 165° F.	95° to 185° F.
No. 1. . .	85 galls.	34 galls.	30 galls.
No. 2. . .	110 ,,	45.50 ,,	40 ,,
No. 3. . .	170 ,,	68 ,,	58 ,,
No. 4. . .	220 ,,	90 ,,	78 ,,

The fresh milk is placed in the bowl-shaped receptacle, passes through the pasteuriser, and then rises by means of the pipe shown on left of figure to the Separator, which, as the name implies, separates the cream from the milk, delivering each one separately by its special spout. The illustration (Fig. 88) shows a "Perfect" separator by the same makers, which is fitted on a specially constructed stand, to which is fixed a shelf to carry a pail. This would require a floor space of about 6 square feet.

The separator itself may be placed on a table or any convenient place in the dairy, and would occupy a space of 1 ft. 3 in. by 2 ft., to 2 ft. 6 in. by 3 ft. 4 in.

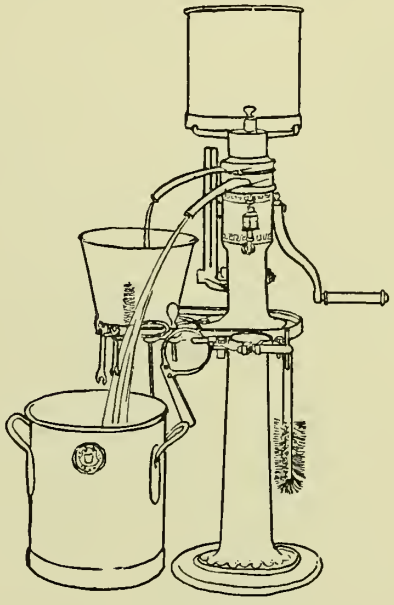


Fig. 88.

These separators for hand power are made of different capacities from 13 to 110 gallons per hour.

For the good preservation of milk it should be cooled after passing through the separator, or when coming direct from pasteuriser. The cooling in all cases is obtained from cold water, which circulates inside the cooler whilst the milk descends from the pan on the top to the saucer at bottom, and thence by means of a tap into the receiving pail.

The conical cooler (Fig. 89) requires a floor or table space varying from 1 ft. 6 in. to 6 ft. 8 in. square, its capacity varying from 36 to 1000 gallons per hour; while the bracket cooler (Fig. 90) occupies even less space.

The separated cream when cooled and ripened is turned into butter by means of a churn, of which there are many forms on the market. The best known form is the barrel churn, as in Fig. 91. Whatever be the shape or form of the churn, the butter-making process is one of rotation,—in some cases by a horizontal movement, and in other cases by a vertical one, as in Fig. 91. The butter has to be broken up, so as to become granulated, by some means or other. In Fig. 91 the apparatus, one of Thomas Bradford's patents, which causes the desired result, is fixed on side as at *a*. When working this is placed inside the churn.

The space required may be roughly judged from the illustrations.

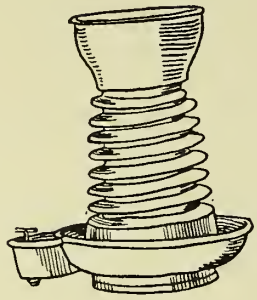


Fig. 89.

When the cream has been duly churned into butter granules it is thoroughly kneaded, in some cases by

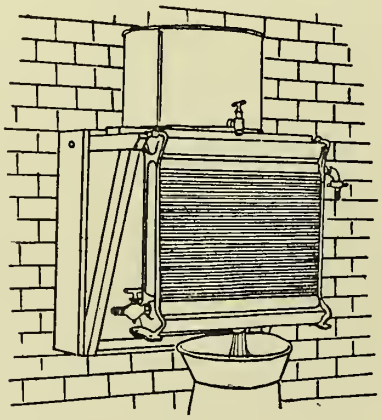


Fig. 90.

hand, but more generally by means of a butter-worker, after the style of Fig. 92. The butter is placed on the

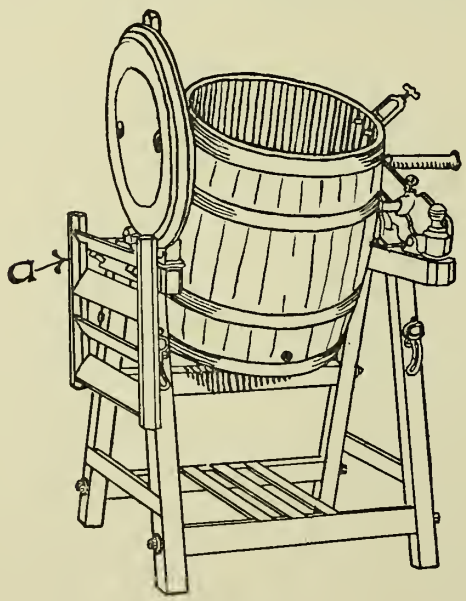


Fig. 91.

corrugated tray, which is then moved backwards and forwards by means of the helical roller. The water which is squeezed out of the butter falls into the draining trough, and thence into a pail or drain grid.

The butter, having been worked to a proper consistency, is removed to an ordinary table, where it is weighed, shaped, pressed, and stamped as may be required. A convenient table (Fig. 93) is that

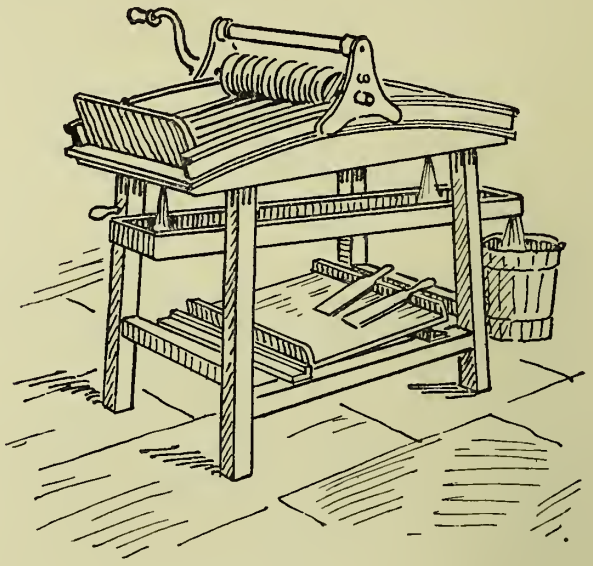


Fig. 92.

made by Messrs. Bradford & Co., which is 4 feet 6 inches long by 2 feet 3 inches wide. In centre of table is a small sunk box made to shape and size, as required, for the finished pat of butter. The butter is placed in this box and pressed together by means of foot treadle and hand lever. The table is of use both in small and large dairies, but especially in the latter.

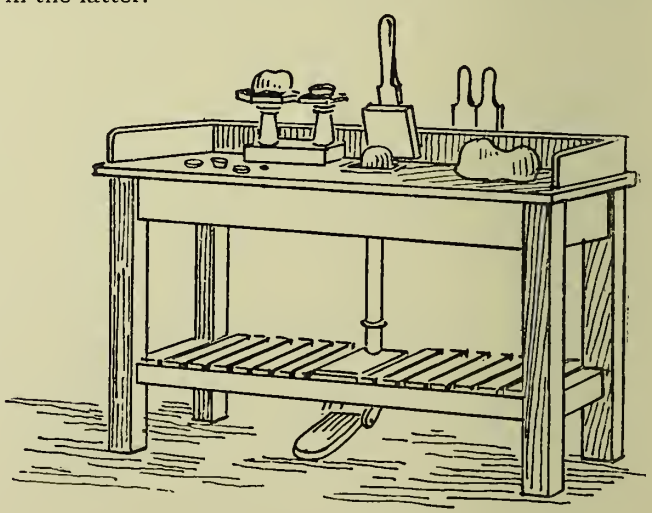


Fig. 93.

The preservation of the finished butter, and its hardening in summer-time, may be effected by the use of a refrigerator cupboard (Fig. 94), which contains shelving accommodation, kept cool by means of the

zinc-lined ice chamber and reservoir. These cupboards vary in size from 3 ft. 2 in. high, 2 ft. 5 in. wide, 2 ft. deep, to 5 ft. 9 in. by 4 ft. 10 in. by 2 ft. 7 in.

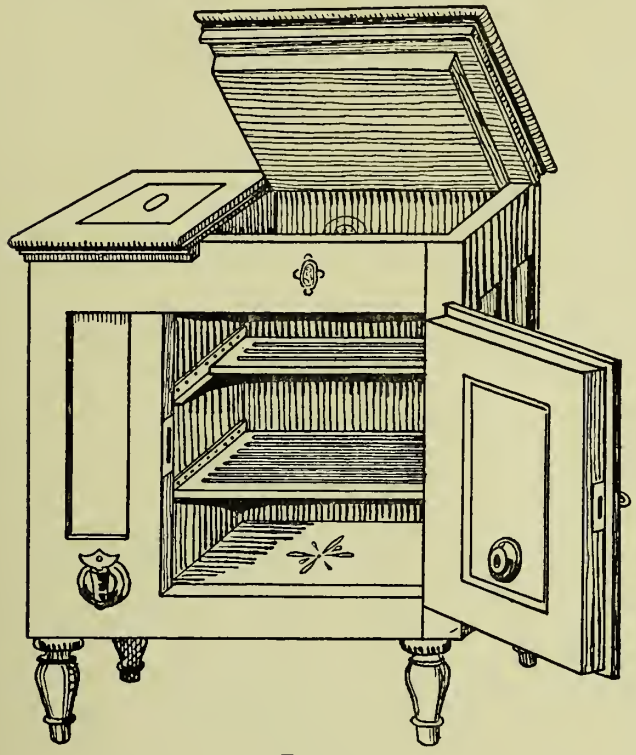


Fig. 94.

Although milk-weighing machines would scarcely be used in small dairies, it may be as well to deal with

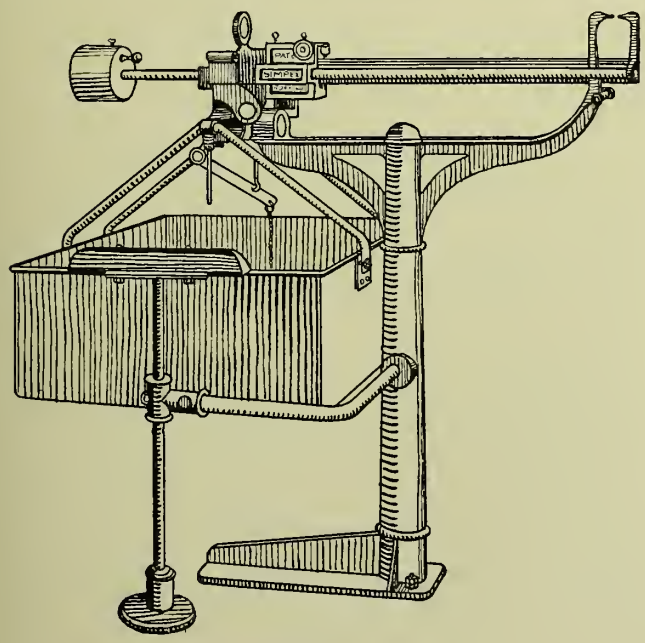


Fig. 95.

them here. Many devices are manufactured with the weighing mechanism below the tank. The tendency of the water and milk to trickle into machinery and so corrode the bearings is avoided in such appliances as that shown in Fig. 95, where the tank is suspended below the weighing mechanism. The weighing machines should be placed, as will be readily understood, in some convenient position where the milk is received, and again where the prepared milk is issued for selling purposes.

Pasteuriser—Cooler—Regenerative Heater

It is necessary, in all cases, to render milk and cream perfectly healthy. To do this the only really

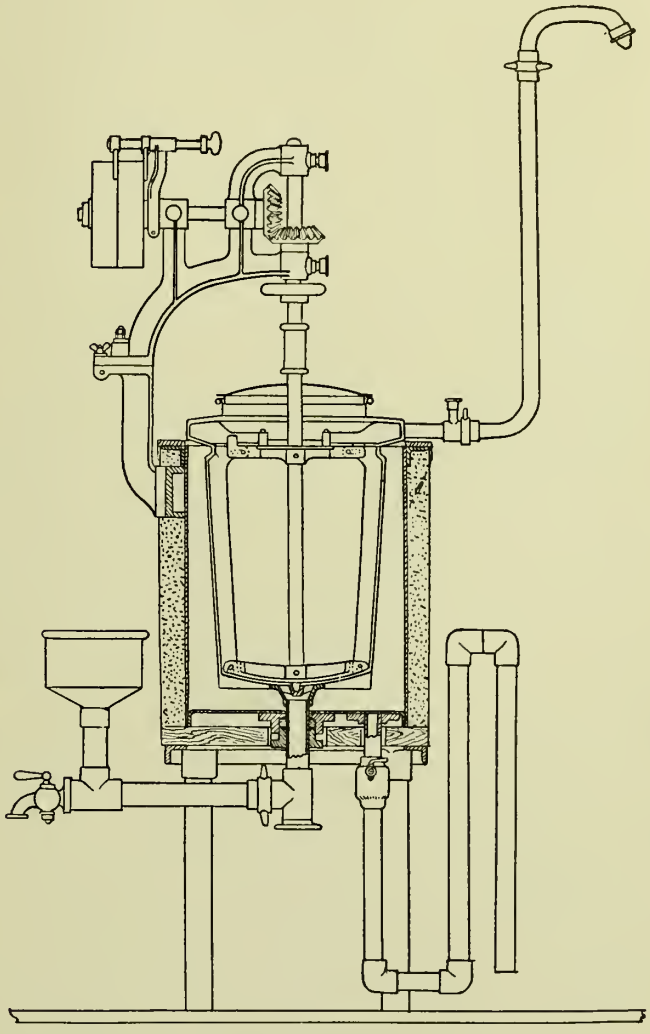


Fig. 96.

safe method known at the present time is that of pasteurisation. Its purpose is to destroy all disease and spore-producing germs in the raw milk. This is accomplished by submitting the milk to such a temperature that the germs will cease to live, and yet at the same time not destroying the good properties of milk and cream. 140° F. have been found, by experiment, to meet the case if sufficient time is allowed for complete germ destruction to take place. In the machinery chiefly used the flow of milk and cream is

slowly continuous, and does not occupy the length of time necessary. To counteract this, the milk is generally submitted to a temperature varying between 170° and 180°, the pasteuriser being made to heat up to 194°. The pasteuriser consists of a steam jacket built of heavy steel plates, insulated with a thick layer of felt covered over with polished steel plate. Within this

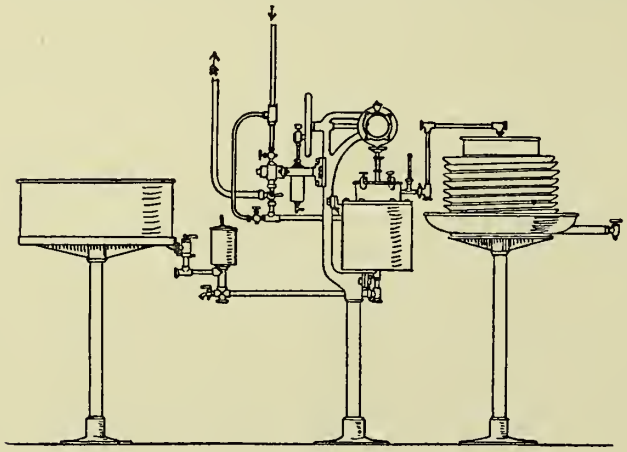


Fig. 97.

is a paraboloidal shaped pan usually made of stout tinned copper plate. The milk enters into the inner pan at its base, and here is forced round by means of agitators, which gradually raise the milk to, if necessary, some 3 feet above the top. The agitator may be driven by a belt from the engine shaft, or by steam or exhaust steam from the boiler. The top is

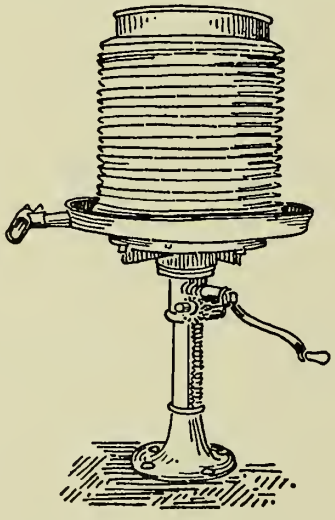


Fig. 98.

fitted with a polished copper cover, and this forms a complete enclosure to the milk, which would suffer in its pasteurising process were it exposed to the air. A pasteuriser such as the one illustrated (Fig. 96) would occupy a floor area of approximately 3 feet by 2 feet 6 inches.

The view of a small plant with a steam driven pasteuriser (Fig. 97) gives an idea of a simple, but compact arrangement for the treatment of milk, which is tipped on arrival into the tank, whence it will travel by means of a pipe, entering the pasteuriser at its base, and rising by centrifugal force to above the cooler. To prevent the fermentation of the highly heated milk it has to be cooled down as rapidly as possible to some 38° to 45°. The cylindrical cooler, of 3 feet by 3 feet area, and varying from 2 to 3 feet in height, cools the milk, which falls into the distributing saucer, or mantel at the top, and trickles down the corrugated sides into the saucer beneath; the cooling agency being either cold or iced water or brine, which makes its way along the corrugation on the inside of the cooler. The cooler is

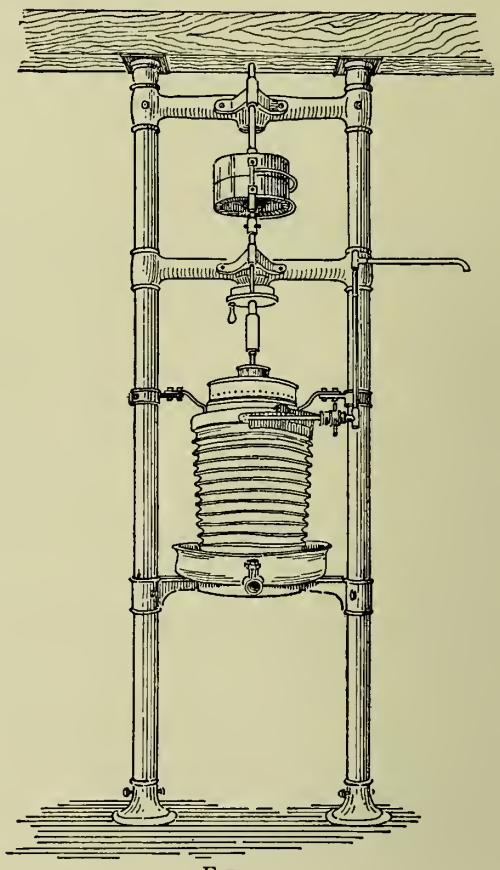


Fig. 99.

connected with the water supply or brine-producing plant. It is made of stout tinned copper in a perfectly cylindrical or slightly conical shape. The inside fluted mantel, connected with the cold water or brine, is quite detachable and easily removed for cleaning purposes. In the case where no pasteuriser is used the milk, being only of low temperature, would be cooled sufficiently by being run over one cooler chilled by cold water, or preferably by a small refrigerating machine. When pasteurisation takes place, the milk, being raised to some 170° to 180° F., will not be sufficiently cooled over a water cooler, but should be passed on to a brine-chilled cooler, where the temperature of the milk is further lowered, and is in a condition to

be stored in a tank, from which it is drawn to be distributed to consumers. Cream is taken through the same process, and is then stored to ripen preparatory to its being turned into butter. The milk, remaining after separation from cream, is also chilled, and is then returned to the farmer. A cooler, made by Messrs. Douglas & Sons, is shown in Fig. 98.

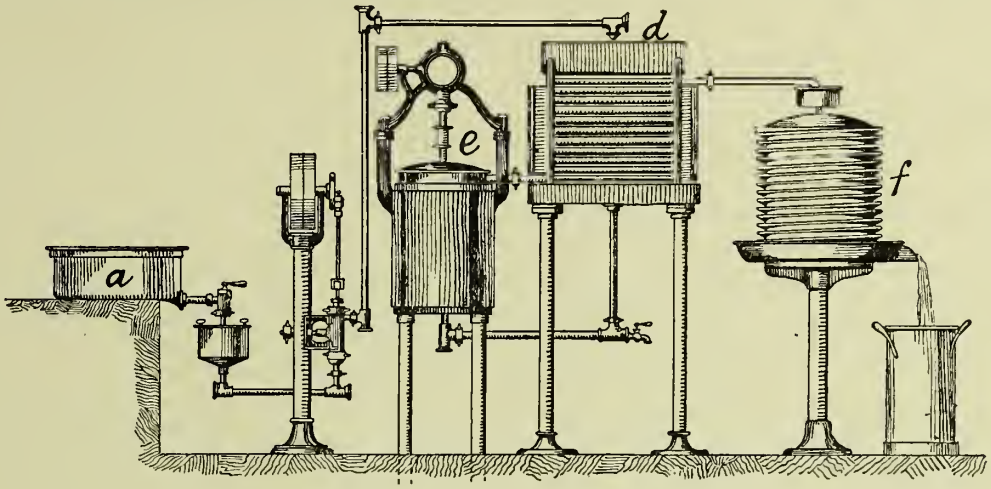


Fig. 100.

purpose is to exchange temperature between the fresh cold milk and the pasteurised milk. The fresh milk thus heated goes into the pasteuriser to be raised to a complete temperature, whilst the half-cooled milk is further cooled for milk distribution. This heater (Fig. 99), 3 feet by 2 feet, consists of a distributing pan at top, over a thick tinned copper capillary surface of

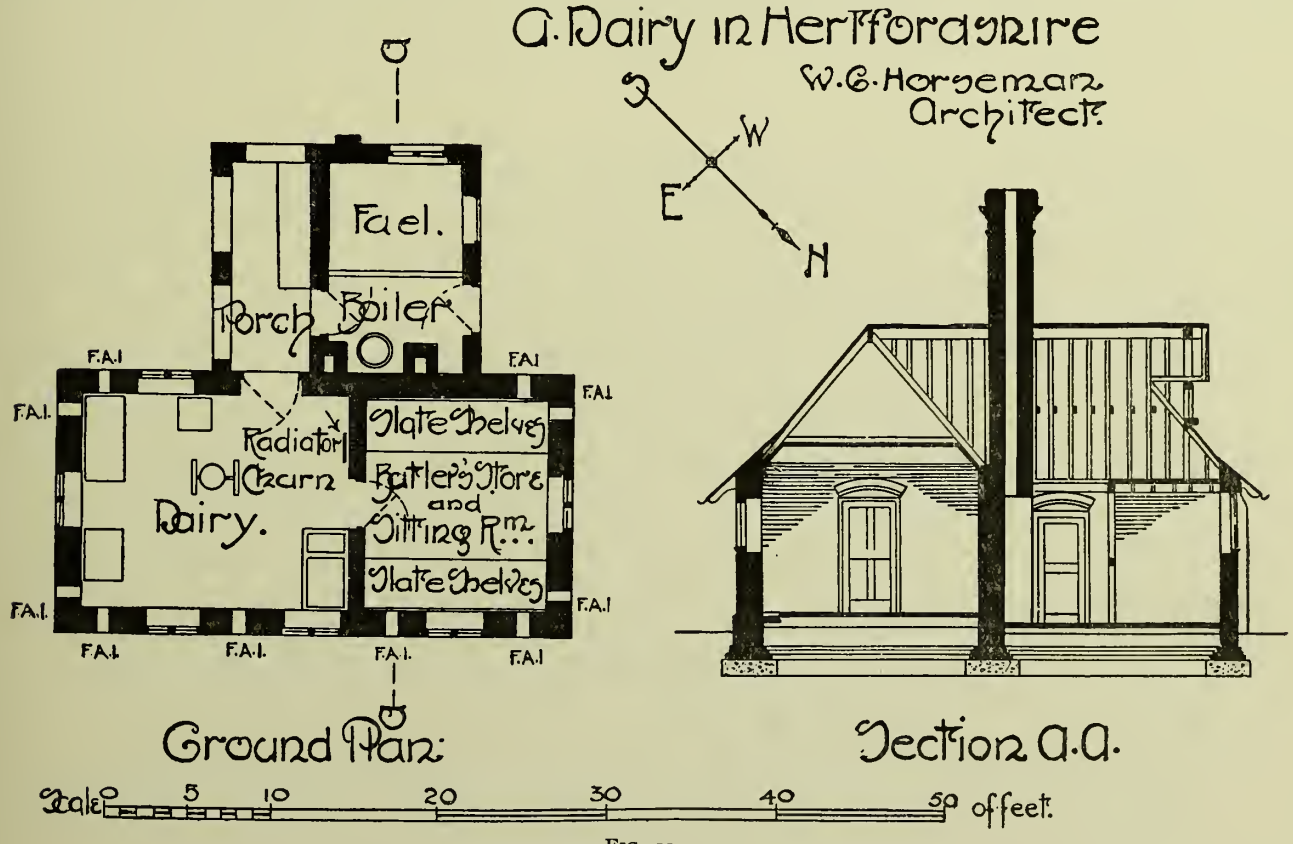


Fig. 101.

An apparatus which tends to economise the use of steam and water is that known as a Regenerative Heater or Temperature Exchanger. It cannot be said that it is in general use, in spite of its many advantages. Its inverted cone shape. Within is a shaft to which is fixed a revolving agitator. The fresh milk is either pumped into the top pan or rises from the pasteuriser; it then flows through the apertures in the mantel over

the corrugated surface till it reaches the bottom saucer. Whilst the new milk is travelling downwards over the outside cooler the pasteurised milk enters at the bottom of the apparatus and is circulated by the agitator, so rising upwards, and is eventually discharged through the pipe at top, emptying itself over a cooler.

The plant (Fig. 100), occupying 18 feet by 4 feet, consists of a receiving tank *a*, from which the milk is pumped to the temperature exchanger *d*, travelling downwards enters at the base of pasteuriser *e*, rises into exchanger once more, and rises and flows into cooler *f*. The regenerative heater here shown differs somewhat from that explained above. It consists of a series of brass or copper tubes joined together. The apparatus is rectangular, and is fitted with movable ends for cleaning purposes. The cold milk may be made to travel on the outside or on the inside of heater, as may be desired.

A small dairy, erected in Hertfordshire from the designs of Mr. W. G. Horseman, is illustrated in Fig. 101, and shows all the necessary appliances for a "model" establishment, intended to do little more than supply the needs of a large country house. The large number of air inlets will be noticed—for ample ventilation is essential, air outlet being obtained by means of louvres in the gable ends. In larger establishments the retention of equable and exact temperatures at all times of the year is a matter of great importance, and heating and cooling appliances have to be introduced, adding no little to the complexity of the problem of planning a complete dairy, whether it be for the supply of milk only, or of butter, clotted cream, or cheese in addition.

MORRIS'S ELECTRIC MACHINE BAKERY, RICHMOND.

CHAPTER VIII

BAKERIES AND BAKERS' FITTINGS

(Contributed by Hedley C. Quérée)

The number of storeys of which a bakery is composed will regulate the placing of the various machines. Generally speaking, it may be taken that the flour is stacked on the topmost floor, and that this is shot into hoppers which are connected either to blending machines fixed just below the ceiling, or else to kneading and mixing machines placed on the floor below.

The ground floor accommodates the dough-tables, dividing machines, and ovens. It is therefore necessary that the construction of the floor itself should be of such strength that a heavy dead load can be carried with safety. The concrete surface should be made with an easy gradient to enable it to be swilled down, for according to the Factory Acts all traps and drainage must be kept outside the building.

In small bakeries, or in localities where land area need not be considered, it is more convenient to place the kneading machine and ovens together on the ground floor.

The success of a baker greatly depends on his ovens, and great care should be exercised in the selection of these. This choice will regulate the construction of the bakery, and a change of opinion on the part of the baker-client would probably result in a radical change of planning, which is much to be avoided.

The ordinary builder-constructed farmer's or baker's ovens, as found in most places which date some way back, are scarcely ever built now, except perhaps in farmhouses, where the spirit of conservatism is prevalent. The modern baker would certainly never dream of building such an oven where he could obtain a specially constructed one as described later. However, Fig. 102 represents the plan and section of such an oven, consisting of an inner skin of 4½-inch brickwork laid with a very fine joint of clay mortar, and an outer skin of 9-inch brick or stonework built in ordinary lime mortar. Between these two walls is inserted a 2-inch thickness of sand, which would also be carried over the 9-inch brick arched vault.

The general contour of the interior of the oven is pear shaped, with the door opening at its apex and the firing arrangements at one side or other of oven door. The flame and heat travel around the oven as shown by the arrows on the plan, and away by the flue. The doors, plates, and gratings are made of cast iron.

The splay at each side of oven door should be made of a good width, so that facility of movement will be given to the "peel" to work round to all sides of oven. The "peel" is a flat wooden spade with which the bread is placed in or drawn from the oven, technically known as "setting" and "drawing." The space beneath the iron sole plate is generally devoted to stocking coal, whilst that beneath the furnace grating is for the reception of ashes.

The sole or floor of the oven is made of good stout tiles, bricks, or stone, which must be of a very fine texture and free from grit of any description ; as there is a continual friction from the action of the peel, which would cause trouble if the sole surface were not perfectly even in its wearing qualities.

The best place for the oven is in the corner of the bakehouse, so that the flue may pass conveniently from over the oven door into the wall alongside. Where this is impossible and the oven is merely backed against a wall, the flues would have to be carried by means of a gradual slope to the wall at back, an arrangement which should be avoided, as it becomes both an unsightly object and affects the drawing capacity.

When the bread is in the oven the door is left open, and an iron blower is placed on the iron sole plate, as shown dotted on plan, so enclosing the flue in the oven. This blower is made semicircular in shape, of stout sheet iron with two handles, and a glazed inspection hole through which the baker can watch the baking process.

The drawing shows a low vault roof: 18 inches at its springing level and 2 feet at head. Many ovens have been made with a higher vault, but it has been found that bread will not rise so well in these as in the low-crowned oven. The top of the oven can be utilised for setting dough, etc. A very convenient arrangement is to place a water tank above the furnace, fitted with service pipe and draw-off cock.

Ovens are either internally or externally heated, the former method as just described being used in farmhouses and older bakeries, but now rarely—if ever—built in a bakery of any size. The externally heated ovens are those fired by steam pipe or hot air. The former are economical and continuous, but require careful and undivided attention, as well as freedom from a chimney inclined to down draught.

Hot-air ovens vary considerably, the majority being

extravagant in fuel and difficult to regulate, but the better ones are more economical than steam-pipe ovens, and are not affected by down draught or irregular attention. Steam-pipe ovens in their turn may be heated either by a furnace, fed by coal or coke, which

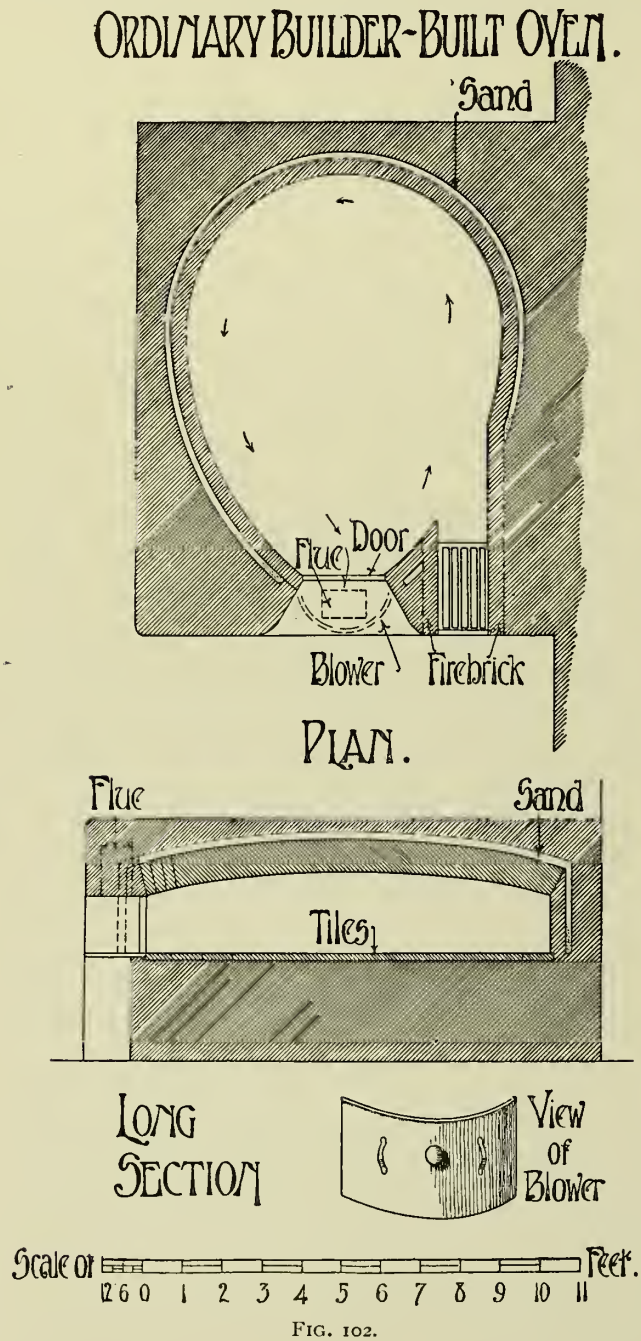


FIG. 102.

produces a certain amount of dust and dirt and requires regular stoking, or, as is becoming more generally adopted, by gas, which is regular, continuous, and requires little or no attention.

Ovens are generally fired at back, side, or front of bakehouse; preferably the former, as this will allow of the extension of the range of ovens at any future time. Space at the back of oven must be allowed for the stoking arrangements, the floor being at a lower level than that of the bakehouse.

A steam-pipe oven requires a greater space than one fed by hot air, for the former has its furnace added to the length or width of oven, according as to whether it is fired from back or side, whilst the latter has its furnace beneath. The stack to these ovens contains flues varying from 6 inches circular to 14 by 9 inches rectangular.

The ovens themselves, as made by special bakery engineers, may be divided into two classes, namely, drawplate and peel ovens, the former being used in preference to the latter where space allows. In the lower part of Plate III. is illustrated an interior view of Messrs. Morris & Sons' bakery at Richmond. Drawplate ovens made by Messrs. Werner, Pfleiderer, & Perkins are shown, with a peel oven on the extreme left. The upper part of Plate II. shows the electric machinery.

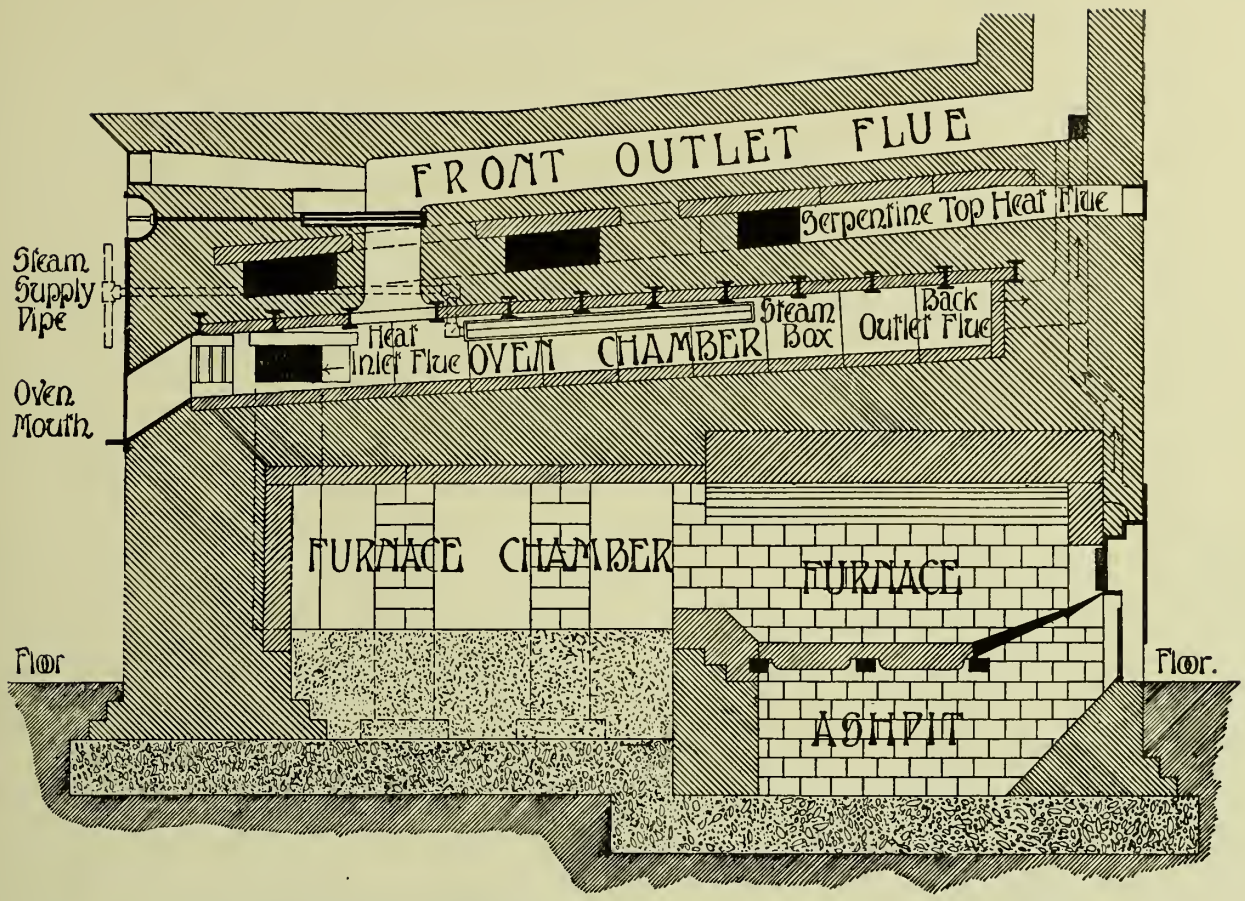
The drawplate oven, as the name implies, is one where the bed or bottom plate is made to draw out. It consists of a brick-enclosed chamber heated by steam pipes above and below the baking space, which pipes contain a certain amount of water and are hermetically sealed at both ends. The fittings are made of heavy iron, as is also the bed of the oven, which runs on ball bearings and with telescopic motion on the framework, which in its turn runs over a special track fixed into the concrete floor. The iron door is made close fitting, and is raised by means of chain and wheel at side, its action being counterbalanced by a weight. A clock is generally placed above these ovens, which is set at the time at which bread is introduced, so that the attendant can know accurately the time taken for baking.

The peel oven is that in which the bed-plate is a fixture, and the doors are made to open on hinges or to slide, the bread being inserted into the oven by one of the many kinds of wooden shovels known as "peels."

The drawplate oven possesses the advantage that it can be loaded very expeditiously, and inspection of the whole baking can be easily accomplished. On the other hand, where the space in front of ovens is limited, then the advantage of the "peel" or fixed oven predominates.

Ovens may be made to suit any particular arrangement and for any kind of bread. A general idea of the construction is shown in Fig. 103, the point of difference being the flat and sloped bed. The external walls are finished off with glazed brickwork in one or more colours as fancy dictates, and this can with advantage be carried around the sides of the bakehouse itself, or where cost has to be considered the walls may be cemented and painted.

The ovens may be arranged in various combinations, as, for instance, with double decker drawplates, *i.e.* one drawplate above the other, each with its set of



CONTINUOUS FRENCH & VIENNA BREAD OVEN.

FIG. 103.

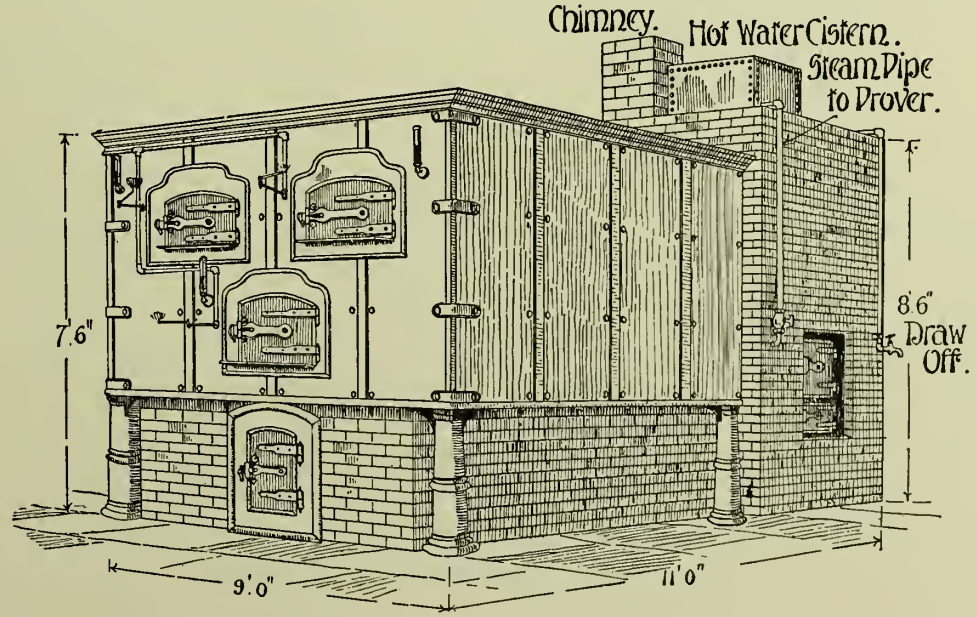


FIG. 104.

rolling tracks; or the same arrangement with two peel ovens; or again, with one peel oven and one draw-plate one above the other. An oven used for French and Vienna bread is shown in section in Fig. 103. This is as made by Messrs. Joseph Baker & Sons, the main difference from an ordinary oven being that the chamber has a lower roof, whilst the sole is inclined and is generally made of glazed tiles. These ovens may be built one above the other, both with inclined soles or else one inclined and the other level. They can be supplied, if so desired, with flash heat, besides the ordinary steam heat, which is said to give a delicate colour and crisp crust to the bread. Flues

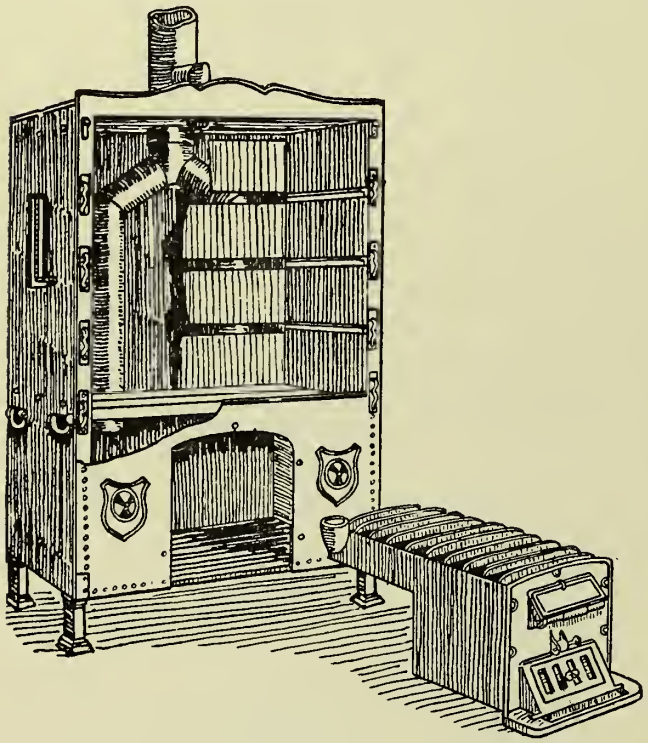


Fig. 105.

are introduced into the oven through which the heat from the furnace can be drawn whenever required, being under entire control of the baker in attendance.

Messrs. Thomas Collins & Co. make ovens which differ in construction from those above described. The oven and furnace (Fig. 104) occupies a floor space of 9 feet wide and 11 feet deep. In this the ovens consist of one large lower oven 8 feet square, and two smaller separate ovens above, each 8 feet by 4. The combination may be varied from one oven to four single ovens in two tiers, the single oven being 5 feet wide. When a mixed trade is done each of the compartments may be used for different purposes, and warmed at different temperatures.

As will be seen by the illustration, the oven itself is composed of iron, which is in two thicknesses separated by a layer of non-conducting material. The space beneath the oven is utilised as a proving cupboard. The oven, on account of its structure, adapts itself to situations where it is expedient to place it on the first floor of a building.

The heat is obtained by means of a fuel fire in the furnace at the back, and a series of tubes is carried above and below the baking compartments, a steam boiler is placed above the fire, which can supply steam to the ovens and prover.

A portable oven may not be out of place. One made by Messrs. Chas. Portway & Sons is shown in Fig. 105. It is 2 feet 8 inches in depth, 2 feet 8 inches to 3 feet in length, and 4 to 5 feet 6 inches in height. It consists of double cased iron, packed with non-conducting material. Each shelf has its own door, which drops to a horizontal position when open, so becoming a continuation of the shelf. The fire-box, which extends to the rear of the oven, answers the purpose of a combustion chamber. A movable grate is suspended under the fire-box, and the action of heating is as follows: Air enters through the circular ventilators at each side of fire-box, becomes heated as it passes round the stove, rises in the heated chamber, and reaches the shelves by apertures in the plates, passes over the goods, and

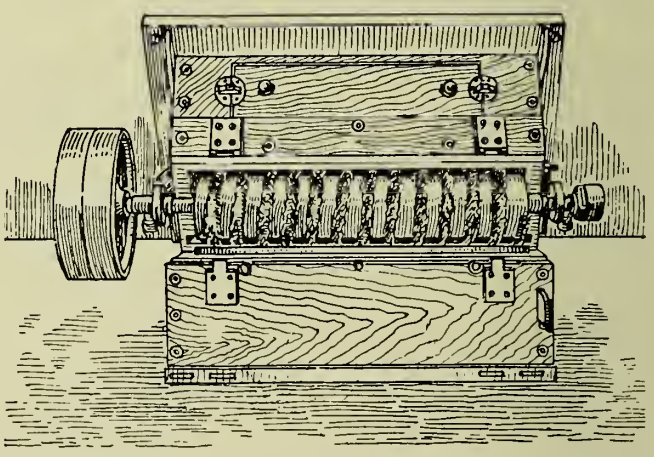


Fig 106.

down again to the front of oven to the stove, where it is reheated. The flue pipes shown are connected to the nozzle in the stove, and as they are branched in two they radiate a greater amount of heat than if one only were used.

Ovens may be built to any size, but that usually adopted has a sole plate 12 feet long and 6 feet wide. Where the floor of the flour store is not of concrete it should be cross-boarded, so as to prevent the flour from passing through. The flour is stored in sacks, and these are emptied into a large wooden hopper, communicating with either a blending or a sifting machine. The latter (Fig. 106), while fixed to the ceiling, consists of a steel shaft covered by a spiral brush, its action being to brush the flour against a sieve at the bottom of the machine, so removing any string, fluff, or foreign matter, which it carries to one end and there ejects into bags or other receptacles. It is 3 feet 6 inches long, including

pulley, and 2 feet wide. The flour is then dropped into a canvas shoot, which conveys it to the kneading machine, where yeast and water are added. This machine consists of a heavy iron framework, the kneading trough being rectangular on plan and having a double semicircular bottom, into each part of which a beater revolves. These act in opposite directions, so affecting a very thorough kneading of the dough.

Fig. 107 shows a machine fitted with two beaters, which is usual, but such machines are also made with one beater only, where the output is small and expense a consideration. The average space required would be about 6 feet 6 inches long by 6 feet deep, and 6 feet 6 inches high.

The kneader is tilted up by means of the hand wheel at back, the whole revolving on its front edge, so easily tipping out the dough into a travelling trough which is made to suit its length and capacity.

In bakeries of average size the flour is bought ready blended from the millers, but where this has to be carried out by the bakers themselves the act of mixing will have to take place before the sifting and the kneading, the flour being conveyed from the blender to the sifter, and then by canvas bags to the kneader. The same style of machine as the kneader may be used for blending or mixing of flours.

The dough is left to rise in the trough, and then is taken to a moulding table or a special machine,—the table being of a convenient length and width according to number of bakers, and fitted with drawers into which the moulded pieces of dough may be placed away from the cold air, which would have the effect of forming a crust on them. Instead of putting the dough into these drawers, it may be placed on a travelling rack, holding a number of trays, each provided with a covering canvas cloth and conveying handle at each end,

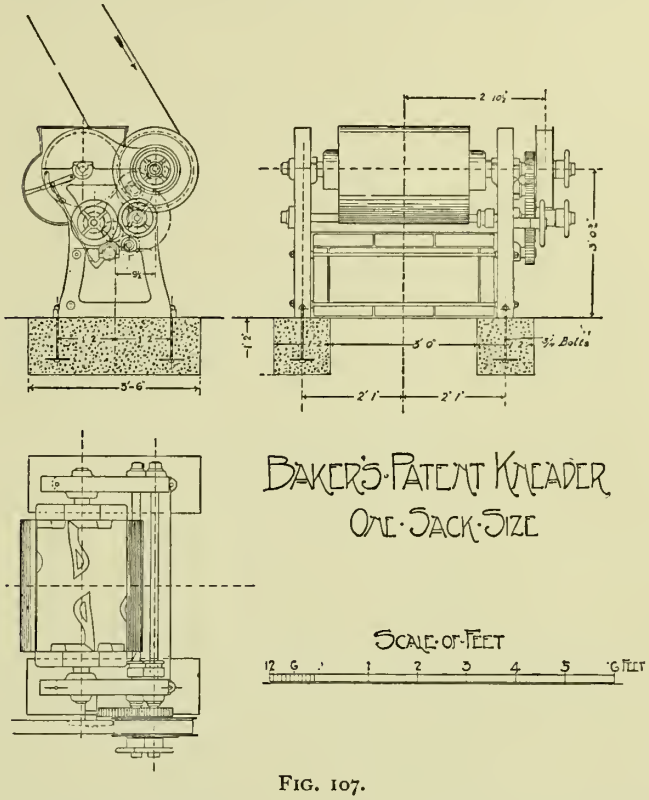


Fig. 107.

so that two operators can easily tip the whole tray load of moulded dough on to the oven plate when this is made of the draw-out pattern, — which expedites matters very considerably.

CHAPTER IX

LIBRARY FITTINGS

(Contributed by H. C. Quérée)

A PUBLIC library may be divided into four sections, namely, newspaper, magazine, reference, and lending departments.

As to the newspaper department, it is, at the present time, a matter of controversy whether it will continue to form part of the public library establishment, or whether it will be altogether abolished. Up to now

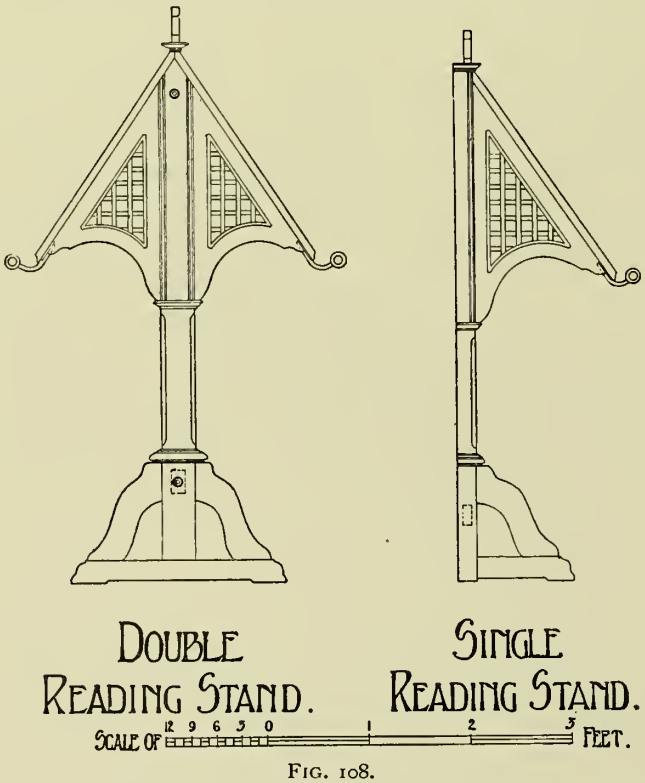


FIG. 108.

it has been a very prominent feature, necessitating a great deal of space, as the majority of general and local papers have to be accommodated. The current issue of each is exhibited on a slope, which may be either fixed around the rooms on to the walls, or may be made double, carried on its own pedestal and placed at right angles to the windows. The former (Fig. 108) has a projection of 1 foot 5 inches at its base, which is 3 feet from the floor if for standing use, and 2 feet 4 inches if accommodated to sitting purposes. In this illustration, showing the Library Supply Company's pattern, the slope is of $1\frac{1}{4}$-inch thickness, and is supported by a 2 by 4-inch moulded wall-piece and bracket. As a newspaper stand has a natural tendency to be top-heavy, it is necessary that the pedestal should be strongly and heavily made. The width across base of slope should be about 2 feet 10 inches. The bottom of slope should be 3 feet and the top 5 feet 3 inches above floor, whilst a perpendicular strip at the apex of slope 4 inches high, serves the purpose of holding the name card of the newspaper placed beneath. To each newspaper is allowed a horizontal length of 4 feet. The paper is fastened to the slope by means of weighted springs at top and bottom, or by a brass rod hinged at top and fitted at the bottom with an eye-piece, which is carried through the wood slope and fastened underneath with a hook or lock or some other attachment.

The double slopes or stands are made to carry one or more newspapers in a length, and should be kept at least 4 feet apart one from the other. In public libraries no provision is made for telegrams, but this has to be done in newsrooms to which admission is obtained by subscription. The newspaper slope may be used for the purposes of their display, but it is more customary to use a baize-covered board, whilst by some it is preferred to place them in a glazed case protected by lock and key. In the latter instance care must be taken to place the case in such a position that the rays of light will not cause an awkward shimmer on the glass, as it is then practically impossible to clearly discern what lies below the surface. An ordinary baize-covered and glazed notice board will also have to be provided in the most convenient position as regulated by the general plan. The same remarks apply to cases placed in the magazine-room for the display of large black and white or coloured plates which form part of the weekly illustrated papers or magazine Christmas numbers. On Plate IV. will be found a photograph of the interior of reading-room of the Edward Pearce Public Library at Darlington. The fittings were designed by Mr. G. G. Hoskins, F.R.I.B.A., and carried out by the North of England Furnishing Company.

Fig. 109 illustrates a slope, which is made for newspapers or periodicals, being kept at a height and inclination which allows of comfortable reading by persons occupying a sitting position. The newspapers of a past issue are placed on ordinary tables, which, where wall slopes are used, would conveniently occupy

the centre of the room. These papers are in many cases left loose, but a better system is to file together some half-dozen back numbers, after which they would be removed to be permanently filed or destroyed according to the custom adopted.

As magazines, reviews, etc., require more continued reading than newspapers they are placed on tables or slopes at such a height as to permit of a sedentary position being taken by the reader. The magazines are usually enclosed in special covers, which may be loosely placed on the table or attached to it by means of a brass chain. The tables may be of the ordinary leather-covered type, 3 feet wide by 2 feet 6 inches high, or may be specially made for the purpose, as that shown in Fig. 109. It is 3 feet to 3 feet 6 inches wide —the best size is 3 feet 3 inches, and of different lengths, which vary from 5 feet to 10 feet long. In the centre of this table, which has a rim of 3 to 4 inches, special brass stands are screwed, into which

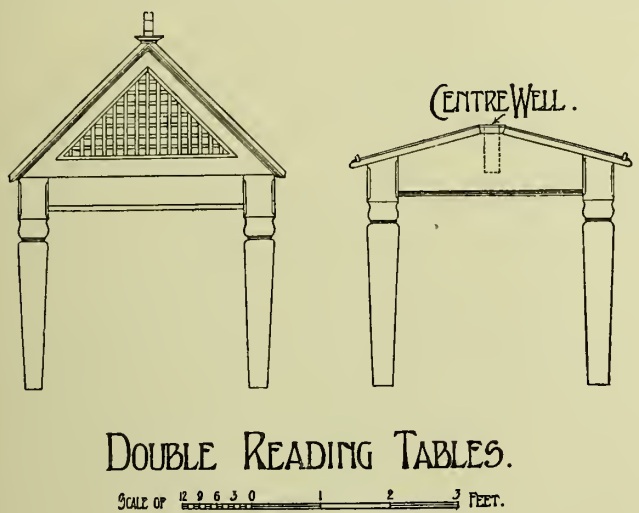


FIG. 109.

are dropped the name cards of the magazine reposing on the slope below. Instead of this a sunk channel of 6 inches depth and 2½ to 3 inches width may be formed in the centre of table, into which the magazines are placed.

As table accommodation for all the magazines would be far in excess of the space at disposal, or far beyond the seating capacity required, a great number of magazines are placed in specially constructed racks, from which they may be removed to the table by the reader and returned to their place when dealt with.

Such a rack is illustrated in Fig. 110, as made by the Library Supply Company to hold some three dozen periodicals. It stands 6 feet high and is 5 feet long and 1 foot 4 inches deep. Another arrangement is to place the rack against the wall, and fit it with carrying laths to which a small fillet should be attached, the magazine being retained in place by means of one or two brass rods on wooden rails, the former being preferable and more generally used. This can naturally be made of any size to suit the accommodation needed, or to fit the recess or space in which it is intended to be placed. Another form of rack is that in which the magazine is kept in its place by means of wire-springs. A rack 5 feet wide and 5 feet deep will hold some forty periodicals.

In the reference department the chief consideration is the comfort of the reader, who will be engaged in a study of some subject which will need his entire and undiverted attention. This should be considered in the arrangement of the tables, so that he may not be unnecessarily disturbed by the cross traffic which certainly cannot be entirely dispensed with. The arrangement of book-shelves will be discussed in the lending department section, under the "Open Access" system, a general idea of which is obtained from a photograph of the interior of St. Deniol's Library (Gladstone

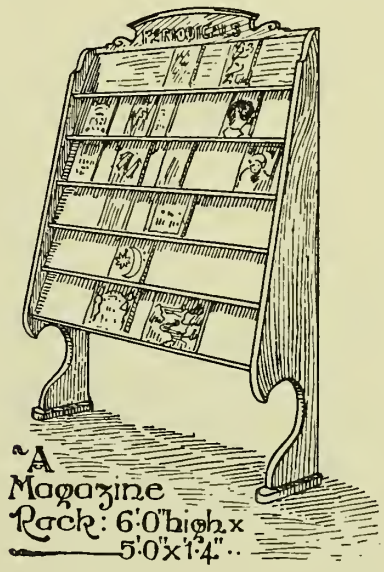


FIG. 110.

Memorial), Hawarden, designed by Messrs. Douglas & Minshull, and shown at the bottom of Plate IV. In this plate it will be noticed that the return ends of bookcases are fitted as shelves. For these may be substituted a moulded wood panel, but it is merely a matter of taste, and both arrangements would accommodate the same number of volumes, as the space lost at end is gained on the side, and *vice versâ*.

In many libraries provision has to be made for map rollers, worked on the same principle as ordinary house-blinds, several rollers being placed one above the other, and protected from dust by a wooden canopy. Valuable books are often preserved in glazed cases, so as to be kept under lock and key, whilst those of very special value are placed in a fireproof safe or strong-room, and only brought out when asked for. The arrangements depend on the status of the library under consideration. The reading-tables may be of ordinary design of 3 feet width and 2 feet 6 inches height, or may have a gentle slope like that shown in

Fig. 109. In any case plenty of space has to be provided for each student. The British Museum gives approximately 4 feet 6 inches in length to each reader, which allows room for the use of several reference books and writing materials, forming in some cases a very large item. Cubicles have been recommended as giving a more complete isolation to the student, but it may be said, as a point against it, that the sphere of supervision is very much restricted, which is a serious matter where books of possibly unique value are liable to be used. A small table (Fig. 111), designed by the Library Supply Company, and adopted at St. Michael's College, Aberdeen, makes each reader independent of his neighbour. It is 2 feet 10 inches long, 2 feet 2 inches wide, and 2 feet 6 inches high, and is fitted with an ink-well, drawer, and extending slide, while an extra shelf may also be added for the holding of books of reference. A table based on this idea may with advantage be adopted, but an improvement could be effected by making it of longer dimensions in cases where the extra space would be obtainable. Where valuable books are often in demand a caution against injury is to pad the table tops. Economy of space and convenience to the reader is accomplished by providing some sort of book-rest, either movable or as a fixture to the table itself. Fig. 112 shows an illustration of the former occupying only 16 by 19 inches, which is simple and compact, folding perfectly flat. This rest arrangement can be incorporated in the table by means of a centre cupboard (see Fig. 113), which would occupy some 9 inches, making the total width of table 4 feet 6 inches to 5 feet. The panel in front of cupboard is bottom hung on a pair of butts, and fitted with a flush spring latch. On being opened this falls on to the table and exposes to view a rest, folded flat, which is raised to the angle desired by means of a wood or brass ratchet arrangement, fixed on either side of the baseboard. An improvement may further be obtained by making the rest to slide forward by means of a brass slot and adjusting screw.

This cupboard should be made to stand 18 inches above the table and be about 2 feet wide, or the full width of space devoted to reader if this is small. A width of 4 feet to 4 feet 6 inches would of course be excessive.

The tables used at the British Museum have a ventilation space provided in the centre of the cupboard, running lengthwise so as to form a hot-air inlet. The top is enclosed by a perforated grating. The cupboard enclosure is carried down to floor level. The front space of cupboard allotted to each reader is divided into three compartments. The centre one is open, and intended for pens, etc., and one of the side ones has merely a hinged flap made of a plate of metal covered with leather. The remaining compartment is more complicated. The door opens out on side hinges, and is double-actioned, being hinged in its centre, as is shown in Fig. 114 by a sketch and a diagrammatic plan. The forearm carries with it a rest, top hung and fixed to position by means of an iron ratchet and plate. The illustration gives the idea of this book-rest when in use, and may serve to explain the description, although the drawing may not be exactly correct as to its detail. To make everything complete, an electric or other reading lamp should be provided to each reader.

Where large folios are kept it is recommended that they be laid flat, as being the position in which there is the least strain. A useful contrivance is to make a low cupboard with its flat top at table level, so that it can be used for such purpose or for the exhibition of reviews, dictionaries, etc. As the withdrawal or putting away of large and heavy folios has a tendency

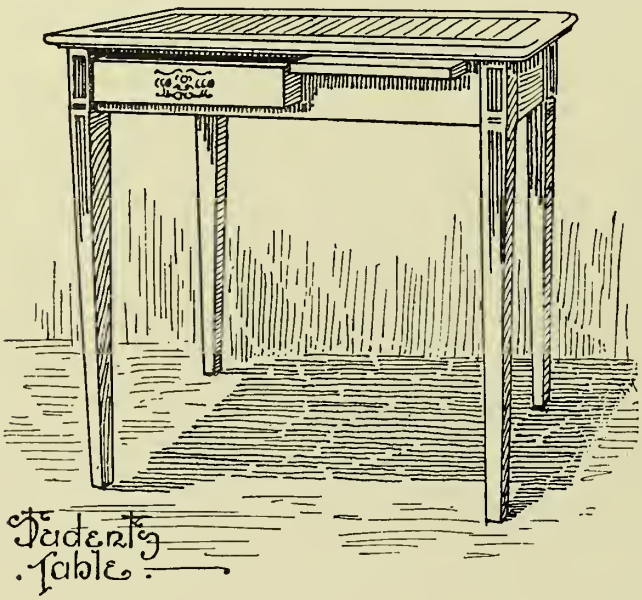


Fig. 111.

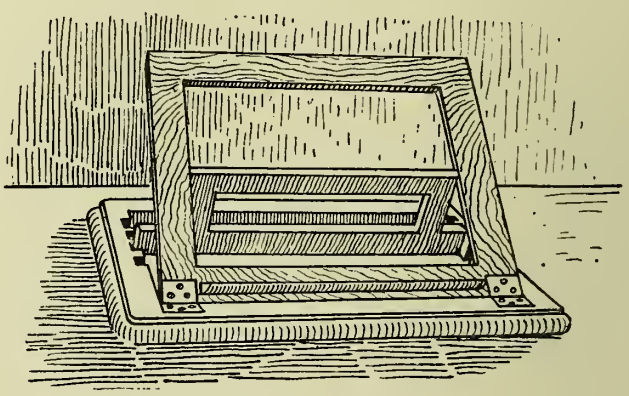


Fig. 112.

to materially injure the binding, some system involving less friction will be advisable, if not essential. An arrangement used to overcome this is to screw to the side of cupboard a number of receivers, on which a loose wooden tray fitted with brass handles or knobs can be placed, so that the tray can be easily drawn out, the folio placed on it, and the whole run into the cupboard without the book incurring the least danger of being spoilt in the process. Another convenient arrangement is to provide a pair of indiarubber lined wood-rollers carried by metal pins running on metal plates fixed to each side of the cupboard. The book is run on these rollers, and certainly would suffer very little, but the former tray arrangement seems the more satisfactory, and the same space is required for both. A card catalogue cabinet would form part of the equipment. This system, which is explained later, has been

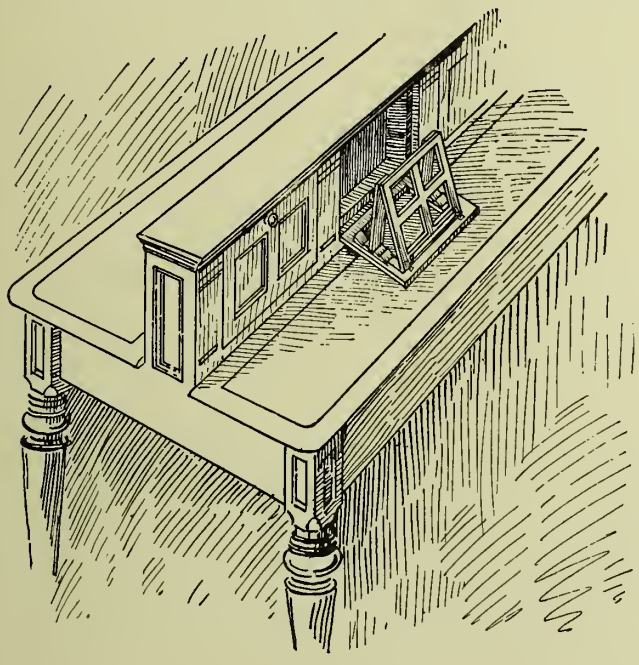


Fig. 113.

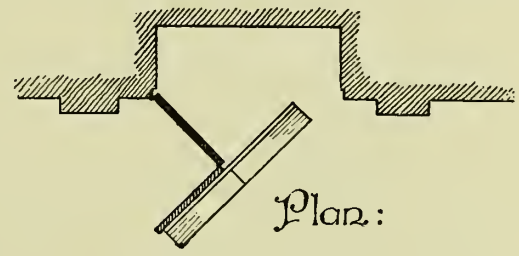
adopted by the majority of reference libraries, whether it is in use or not in connection with the lending department. It is usually provided for the librarian's private use, and a printed "author" catalogue is placed at the disposal of readers. A second card catalogue can, with advantage, be supplied for public use, which will both serve the purpose of giving additions of recent date and also tends to facilitate the revision of the printed catalogue.

In the lending department the system to be adopted, the numerical strength of the staff, and the general arrangement of place require attention, this being the department where the public and the librarians come into direct business relations.

The issuing and receiving of books loaned is effected by different systems, which we may class under the following designations, namely—"Issuing over counter," "Open Access," "Indicator," and "Card Catalogue."

The "Issuing over counter" system may be used in small libraries, or where a great number of assistants are employed. The person requiring a book merely hands over a list to the attendant, who then goes to the shelves and selects the first copy which is not loaned, enters the same in the library book, stamps the date, etc., and delivers to the borrower. This system is being fast superseded by one of the others.

The "Open Access" is that in which the public have access to the book-shelves, and the work of recording



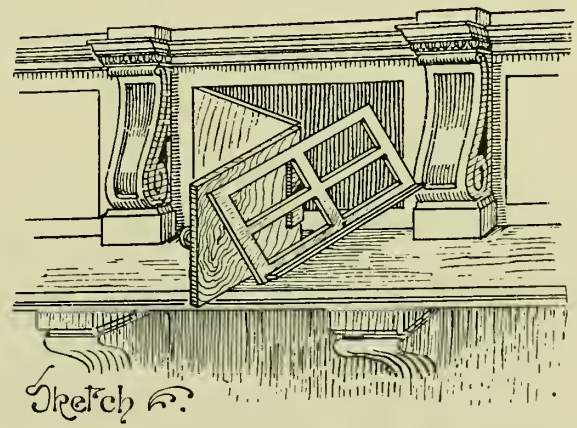


Fig. 114.

the loan is carried out by a librarian seated at a central desk, or by assistants at tables placed conveniently near to the door. This system is largely *en vogue* in America, as also in some of our leading libraries, and, it is believed, will be soon generally adopted. For this arrangement careful supervision has to be considered, and the librarian's desk so placed that he commands as great a view of the shelves as possible, for which a good plan is that of radiating cases with centre desk, whilst the best arrangement is that of alcoves, in which the shelves are placed against the walls with short projecting cases every 4 or 5 feet apart. The centre of room is devoted to desks, flat tables, etc., an arrangement which is perfect in its control, but is guilty of a great prodigality of space.

The "Indicator" system involves the same method of working as that of "Issuing over counter," with

the exception that the Indicator, as the word implies, indicates whether the book required is obtainable or not, so saving the time of the attendant, whilst the system of entry is simpler and more reliable. The indicator itself consists of a light wood-framed glazed case, which stands on the counter (Fig. 115), one or more in number according to the size of library. These cases are so arranged as to leave spaces to form issue desks. The principle is that each book has allotted to it a small tin pan or wood block, with its number painted at both ends. This is done

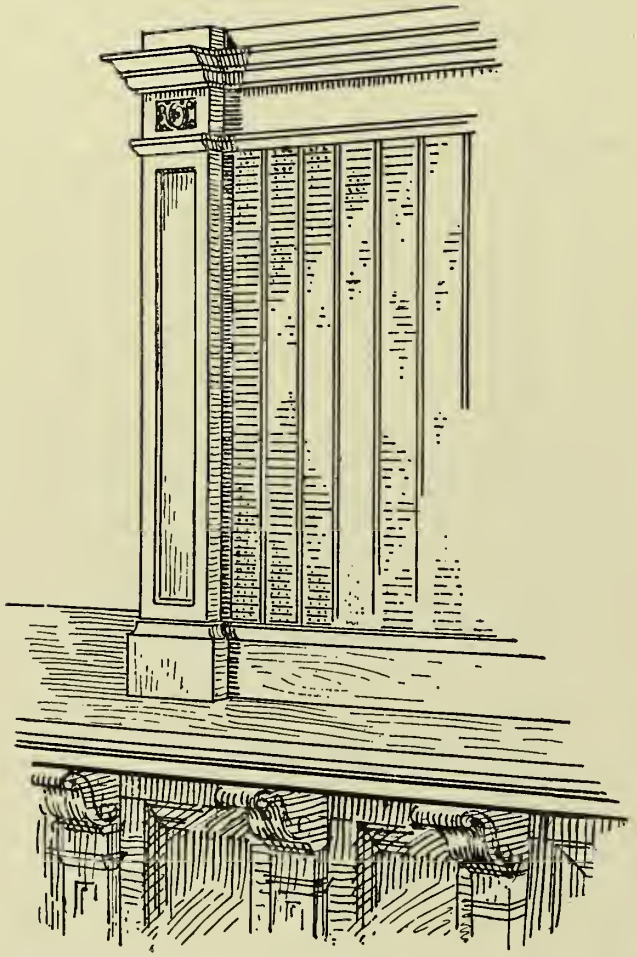


Fig. 115.

in different colours, generally blue at one end, indicating that the book is in the library, whilst if the other end, coloured red, is exposed on the public side of counter the borrower knows that the book is out on loan. These pans are placed on thin tin shelves which run longitudinally in the indicator case. There are different forms of indicators, which vary in space occupied, the "Cotgreave" taking 15 inches running space per 1000 books, whilst the "Libraco" requires 30 inches per 1000. In the tin pan is a booklet or card which bears the borrower's name, and on it the number of book and date of issue are entered. To show clearly when a book has become overdue a thin slip of tin is placed at one end of pan (Fig. 116), a different colour being used for each week. The counter would be 2 feet 6 inches wide and not more than 2 feet 9 inches high, and is generally fitted with a drawer immediately beneath the counter top with one or two shelves below. It will be clearly seen that in a library containing a large number of books the length of counter required to carry these indicators would be considerable. To lessen this it is a general custom to provide indicators for the fiction class only, scientific and other books being obtainable by merely asking for them.

The "Card catalogue" cannot, strictly speaking, be called a system distinctly apart from those before mentioned, as it can be used by itself or in conjunction with the others; but it certainly is most useful in reference libraries, where any persons wishing to find all the different works obtainable on a special subject can easily do so by this means. In an ordinary library worked under the indicator system the card catalogue, apart from other advantages, easily forms the basis for a printed catalogue. Some idea of the importance of the system may be obtained by the fact that this is

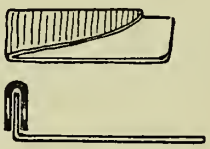


Fig. 116.

Fig. 117.

the special feature of the Concilium Bibliographicum at Zürick, whose aim it is to form a perfect index of all works on scientific subjects, so that where previously a search for such information would occupy weeks, now with these cards a list of the works required would be obtained in a few seconds. This association has a number of regular subscribers, and as new books are published so cards are issued.

The system is very simple, occupies little space, and recent additions can be catalogued without any disturbance to the existing arrangement. It consists of a cabinet containing a number or drawers or card trays, in which are placed cards (one card for each book). Each tray is made to hold 1000 cards,—which are 4 by $2\frac{1}{2}$ inches,—and is fitted with a brass rod running along its length on to which division guides (Fig. 117), lettered or numbered, are fixed. The rod is made flat, so that on its being turned the guide can be easily released. On the card is written the book number in the top left-hand corner, with the author's name and title on the lines following, and the rest is ruled with spaces to record the borrower's number and date of issue.

The requirements for the system are—book-card trays, issue trays, and sorting trays. In the book-card tray (Fig. 118) are placed the cards of all books

in the library according to numerical order. When a book is asked for the card is taken from this tray and placed, together with borrower's card, in a manilla envelope (Fig. 119). The two cards are then placed in one of the divisions of the sorting tray (Fig. 118), and the whole day's working is then sorted out in numerical order, headed by a date guide, and placed in the issue tray, which is of same pattern as the book-card tray (Fig. 118). A fresh tray is used for each day's working. The issue trays are then placed on a special part of the counter, or in a cabinet set apart for the purpose. On the return of the book the assistant knows, by the date of issue, in what issue tray to find the cards, withdraws same, gives back his personal card to the borrower, and replaces the book card in the book-card tray. It will thus be seen that the process is simple and mechanical in its working.

At the Concilium Bibliographicum a cabinet of 72 drawers has been introduced, arranged in 18 tiers of 4 drawers each, the approximate dimensions being 6 feet 6 inches high, 2 feet wide, and 1 foot deep. Cabinets

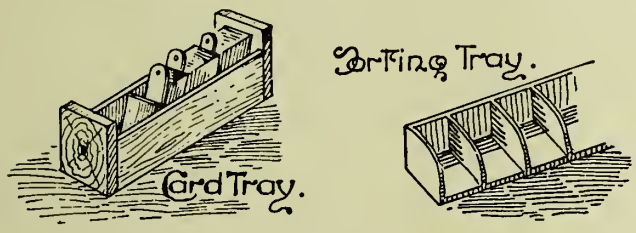


Fig. 118.

to fit on tables (Fig. 120) are made by the Library Supply Company to following sizes—3 feet long, 2 feet deep, and 2 feet 3 inches high. The lower part of the table is 2 feet 4 inches high, and is utilised as a shelf space for large folios. These cabinets may be made in a number of sections containing any combination of drawers, and any section can easily be added thereto.

Whatever issuing and receiving system may be adopted, the shelving arrangements are much alike, chiefly differing in the matter of spacing. With the open access system the cases should be not less than 6 feet apart and not more than 6 feet 6 inches in height, so as to allow of an easy reach. In the delivery-over-counter system the cases may be 3 feet apart and 7 feet 6 inches high, the traffic of the attendants alone having to be dealt with. The book-cases are made of wood or iron, and should be as open as possible so as to allow of ventilation; for all know the musty smell which is experienced on opening a long-closed glazed bookcase. In stack-rooms which are away from the public gaze little attention is paid to the finishing of the shelves, but where they form part of a reference department or open access library, then the ends should be of panelled and moulded walnut, oak, or other such special wood. The shelves should be $\frac{3}{4}$ or $\frac{7}{8}$ inch finished, and supported every 3 feet or 3 feet 6 inches, and the height between them may be calculated at 10 inches for the average volume. Where the stacks are placed across the room, and not against a wall, it is customary to make them double, occupying a total depth of 18 inches.

A plan and other views of the shelving as fitted at

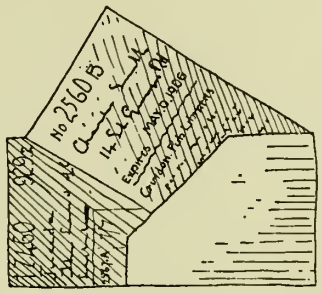


Fig. 119.

the St. Deniol's Library are shown in Fig. 121, while the necessary blocking pieces will be seen where the projecting cases abut against the wall. For shelving which exceeds 3 feet in length a central vertical support is added, fitted with Tonks' adjustments. All these fittings are made in oak, moulded and carved.

It will be of interest to know that the treatment

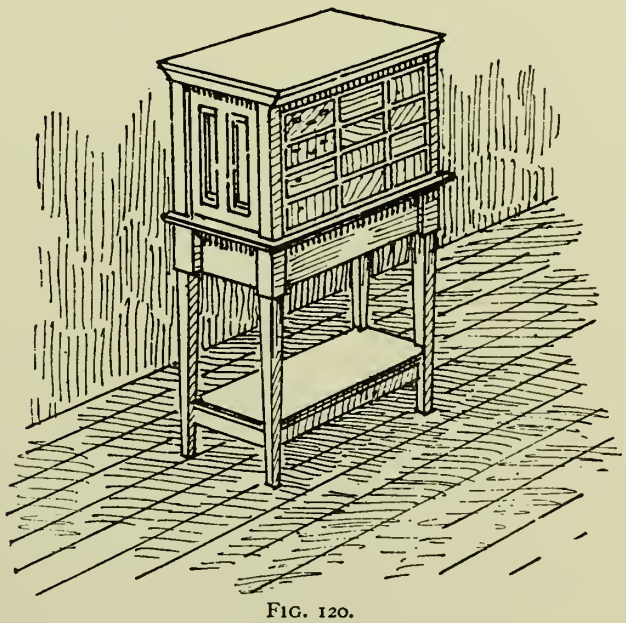


Fig. 120.

of the cases in this library has been carried out in accordance with what the late Mr. W. E. Gladstone found to be the most suitable and convenient arrangement (see Fig. 122).

A fixed wood back may be placed between the two sets, but this is not recommended, it being much better to leave the space entirely open, and to keep the shelves 2 inches away from one another, with a small fillet nailed on the back edge of each to prevent

the books from going too far back. An open mesh wire may also be used as a means of separation. Vertical space is economised and lightness of structure

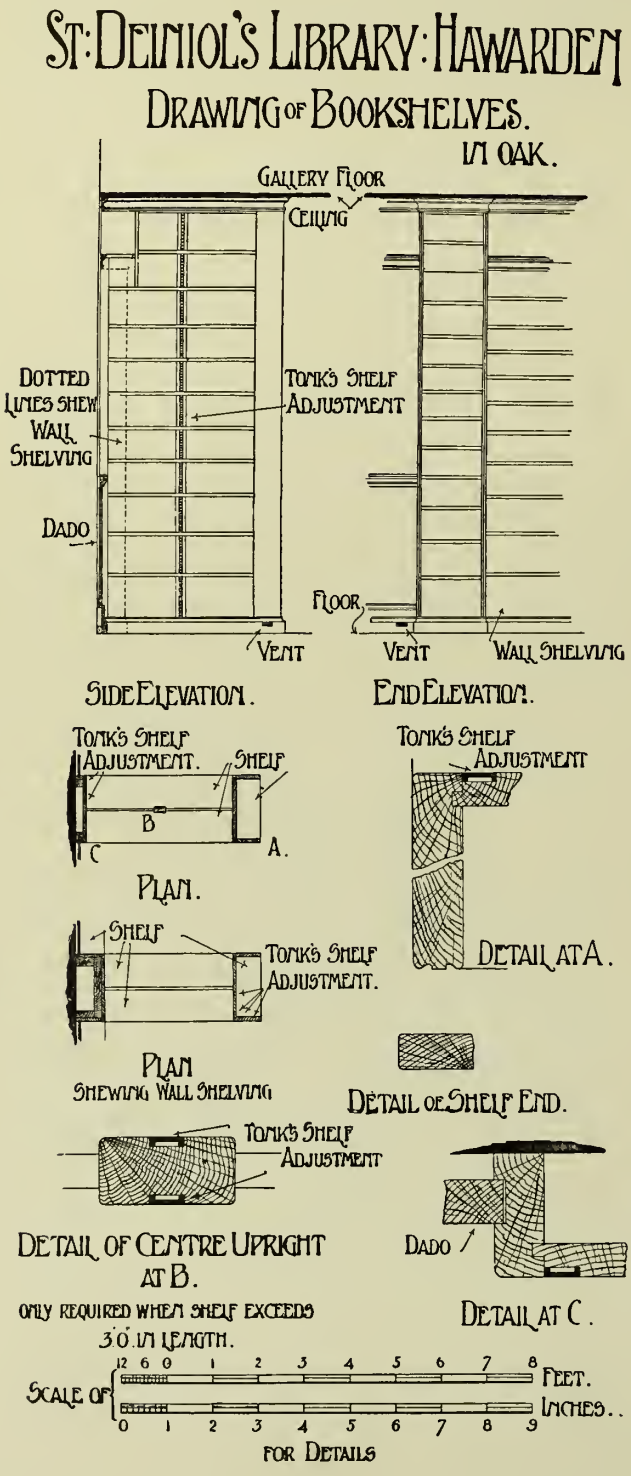


FIG. 121.

obtained by using steel plate for the shelving. This is fixed into a light wooden framework and covered with a layer of leather.

For larger volumes, deeper and higher shelves will

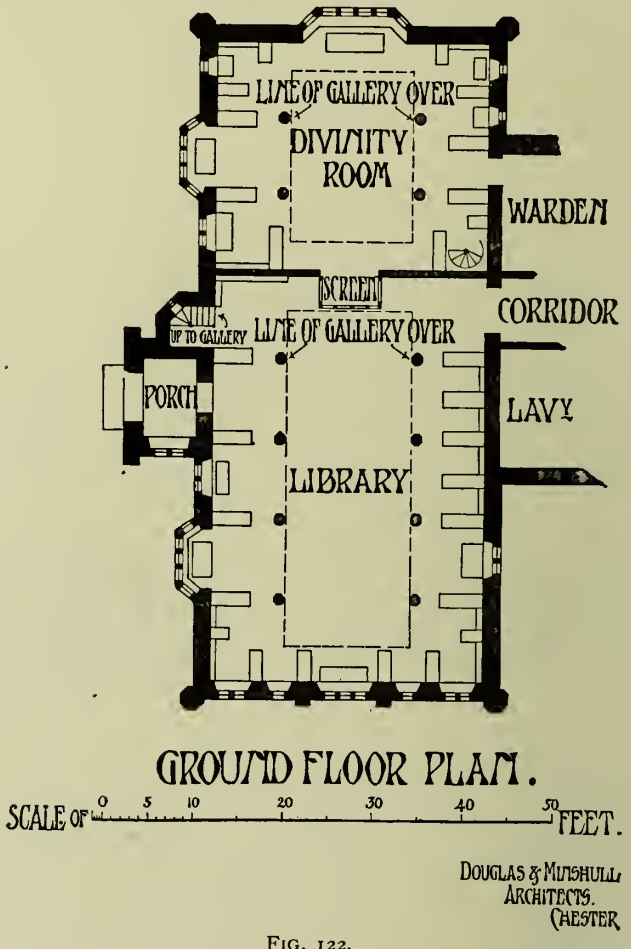


FIG. 122.

have to be provided. Shelves which are made to stock sizes are of $6\frac{3}{4}$, 8, 10, and 12 inches deep;

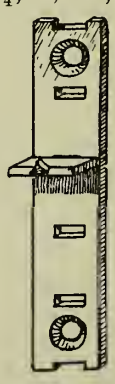


FIG. 123.

whilst the height is regulated by wood cleats or by Tonks' adjustment (Fig. 123), which consists of metal strips fixed to the framework with perfora-

READING ROOM, "EDWARD PEARCE" LIBRARY, DARLINGTON.

[G. G. Hoskins, F.R.I.B.A., Architect.

ST. DENIOL'S (GLADSTONE MEMORIAL) LIBRARY, HAWARDEN.

[Douglas & Minshull, Architects.

tions ¾ inch apart, into which strong metal plates are placed.

Fig. 124 gives the section and elevation of iron framework shelving as supplied to the Patent Office, London, and many other leading libraries. These are made under Lambert's patent, and in stock sizes of 3 feet long, 7 feet high, and 18 inches deep, to carry steel or wood shelving. Any number of these sections may be placed end to end, with the last one, which is exposed to view, either made of ornamentally stamped metal or covered by a wood panelling. At the present day it is deemed advisable not to carry stacks more than 7 or 7 feet 6 inches high, and the extra space of the room, which would probably be of good height, may be utilised by carrying a second tier of cases over the first. The space between the two is fitted with iron-framing, to receive iron, glass, wood, slate, or open ironwork flooring.

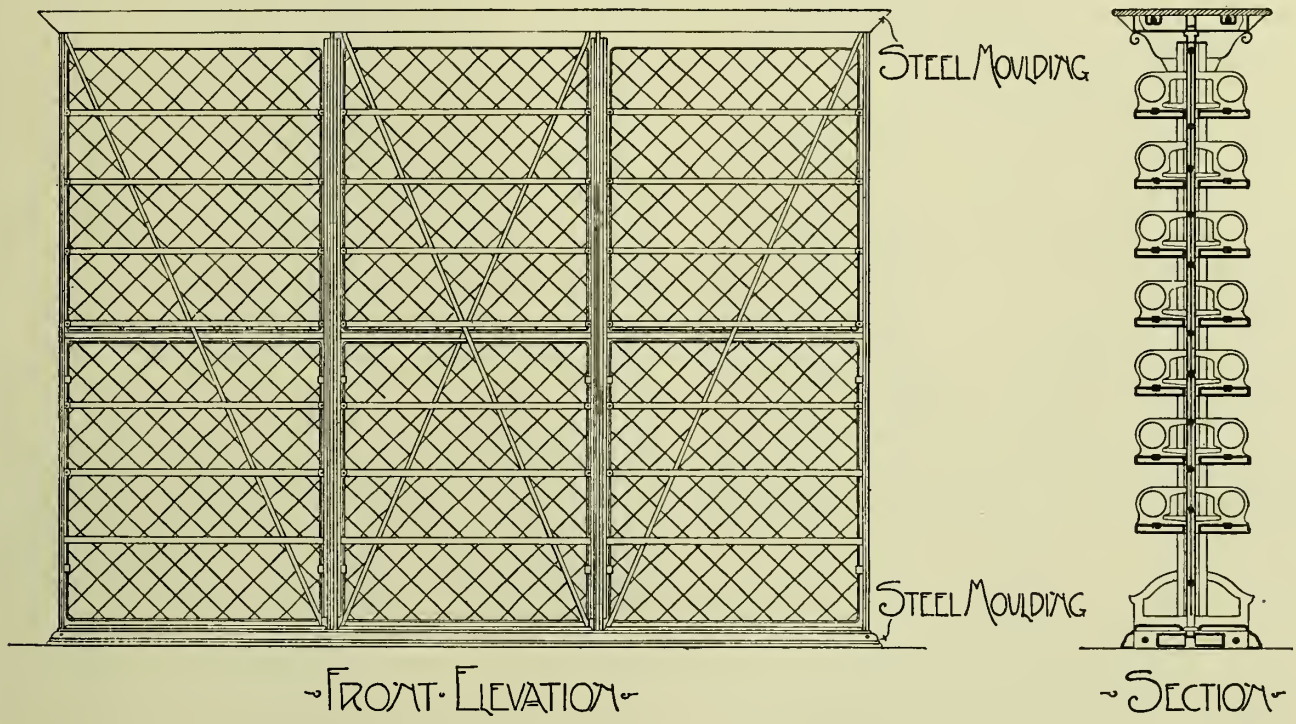


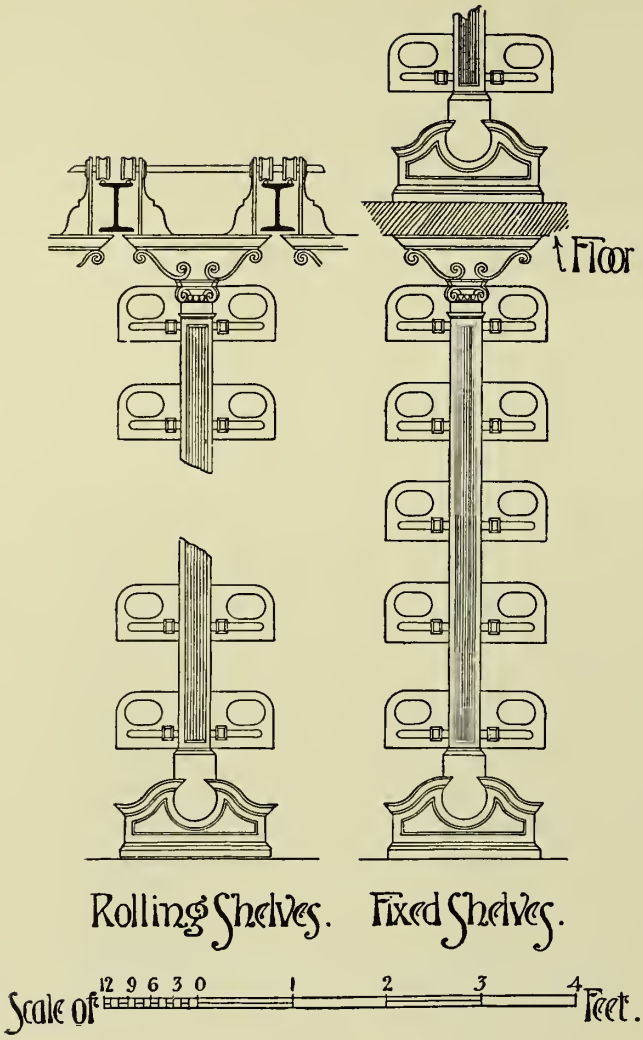
Fig. 124.

Sites are in many instances very costly, and the area at the disposal of the architect will be correspondingly restricted. In such a case it is necessary to make provision for the construction of extra stack-rooms, especially when there is a likelihood of the books outgrowing their accommodation. We have an example of such overgrowth in the case of the British Museum Library. Old newspaper volumes are being removed to an outside home, in order to give space for the volumes which have gradually accumulated and have been piled up awaiting their turn to be placed on shelves. It thus becomes an interesting problem how to fix the greatest number of shelves in the smallest space. To accomplish this, the stacks may be placed in a row quite close to one another, made so as to draw out, being carried on floor runners bedded in concrete, or suspended to an overhead girder track (Fig. 125), which has a half-round steel rail fixed to its upper surface over which the pulley wheels run. It is claimed by the makers that by this system the maximum quantity of books can be stocked away in the minimum of space. A car—as one section of the shelving is called—loaded to upwards of ¾ of a ton can be moved with perfect ease.

Where shelving actually exists in the ordinary way it is impossible to adopt the above system, but something closely akin to it may be arranged by placing small iron rails on the top of the cases, so that they run across the gangway. An extra case can be suspended from these by means of trolleys and hangers, the whole being brought forward along its width instead of its length as above described.

Where the shelving is above 7 feet in height it would be convenient to place on the uprights, where these are of wood, some step device, so doing away with the necessity of using step ladders. Such an arrangement is shown in Fig. 126, consisting of merely a japanned or brass handle and step. There is also the Cotgreave patent (Fig. 127), which consists of a metal plate fixed to the upright, with a hinged flap step which closes flush when out of use, a knob being provided to pull down step when required.

Besides these stacks, a special case for the exhibition of new books is generally placed either on the counter or, if space does not allow of this, then in some position



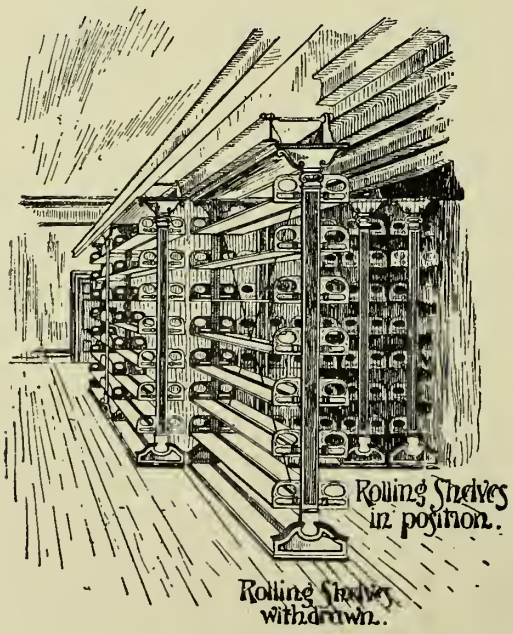


FIG. 125.

convenient of access both to the public and to the librarian. This is generally a wooden case covered with copper mesh wire, with no back to it if on the counter; or if it be at a distance from the librarian, it would have to be made as an ordinary cupboard fitted with doors, lock, and key.

FIG. 126.

Accommodation for directories and similar books should preferably be made in the reading-room or in the public lobby of the lending department. It is a mistake to place these books in the reference department, as they are often consulted just for a few minutes, and without any special silence being required.

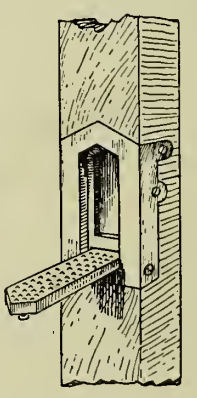


FIG. 127.

Great care should be exercised in fixing the points of light, whether electric or otherwise, so as to flood the whole of the shelves. A great deal of annoyance has been caused to librarians through a lack of appreciation of this section of the equipment of libraries. In a large library of several storeys, book lifts would be necessary.

A system of automatic delivery of books and book-

slips will prove of great advantage to a library which has a great circulation. The Lamson Store Service Company make a speciality of pneumatic tubes, which are adaptable to any sort of business for carrying cash, parcels, etc., and can be of great use in a library. The

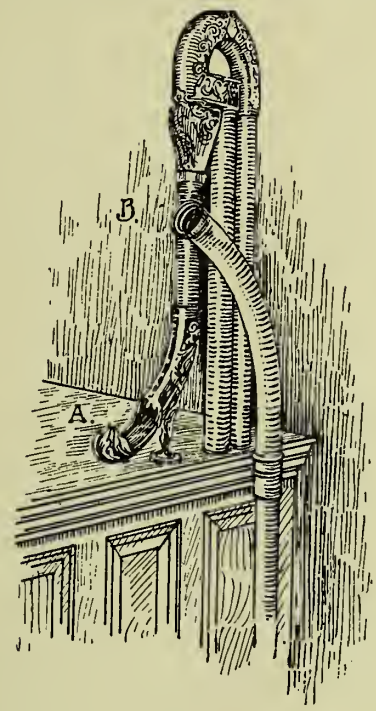


Fig. 128.

tickets are conveyed from the public counter to the stack-rooms by pneumatic tubes, a system which has just been put in force at the British Museum. A series of brass tubes made to any size, but usually of $2\frac{1}{4}$ inches

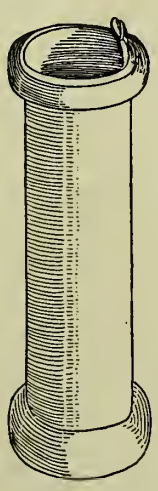


Fig. 129.

diameter, is laid between the various points which are to be connected, the termini being called "dock" stations, whilst those between are termed "way" stations.

Fig. 128 shows the receiving tube (A) and despatch tube (B). The exposed parts are usually finished in antique copper. The motive power is that of air compressed into tanks or reservoirs, and automatically controlled so that there is no wastage. The air is connected by iron piping to the different terminals.

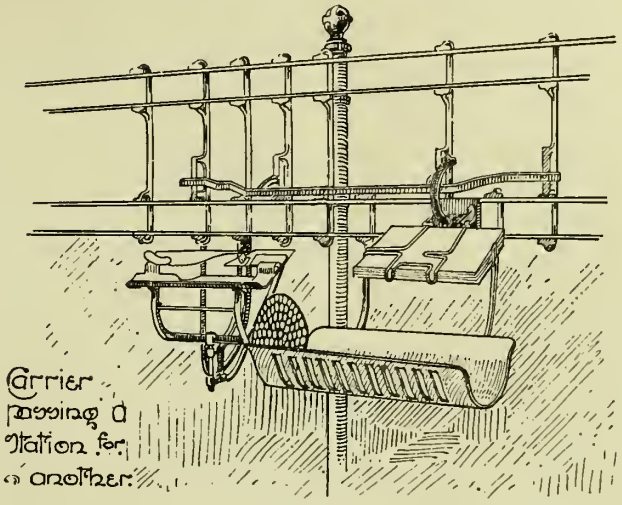


Fig. 130.

The message slip is placed in a cartridge-shaped carrier, such as is shown in Fig. 129, which is then placed in the tube and the door shut. This operation automatically admits the air behind the carrier, and drives it to its destination, where it automatically shuts off the air. The door at despatch end immediately opens, and another message can be sent on. This may be done at the average rate of one every five seconds, and the approximate speed in actual use is 2000 feet per minute. These tubes may be operated by gas,

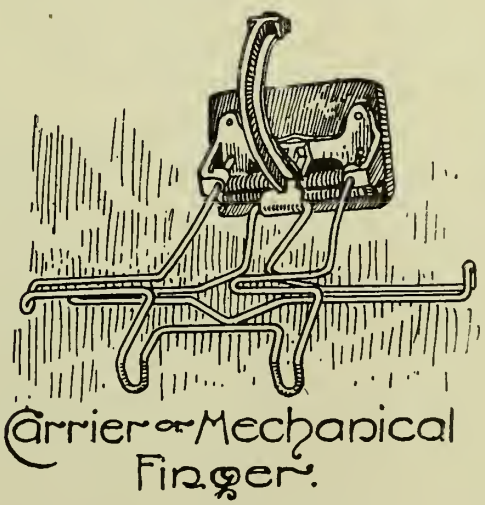


Fig. 131.

steam, electricity, petroleum, or water motors, whichever may be most suitable to the requirements. When the installation is a small one the power may be obtained from a foot pump placed under the counter immediately beneath the despatch station.

The books themselves may be conveyed by means of trollies run on a miniature railway track, and connected from one floor to another by small lifts, the whole process being automatic in its action.

Lamson's pick-up carrier forms an interesting mode of transit, which can be used to carry book-slips, documents, books, or other bulky articles. This carrier is operated by a specially woven cable cord driven by a small motor. At each station there is a despatching and a delivery shelf.

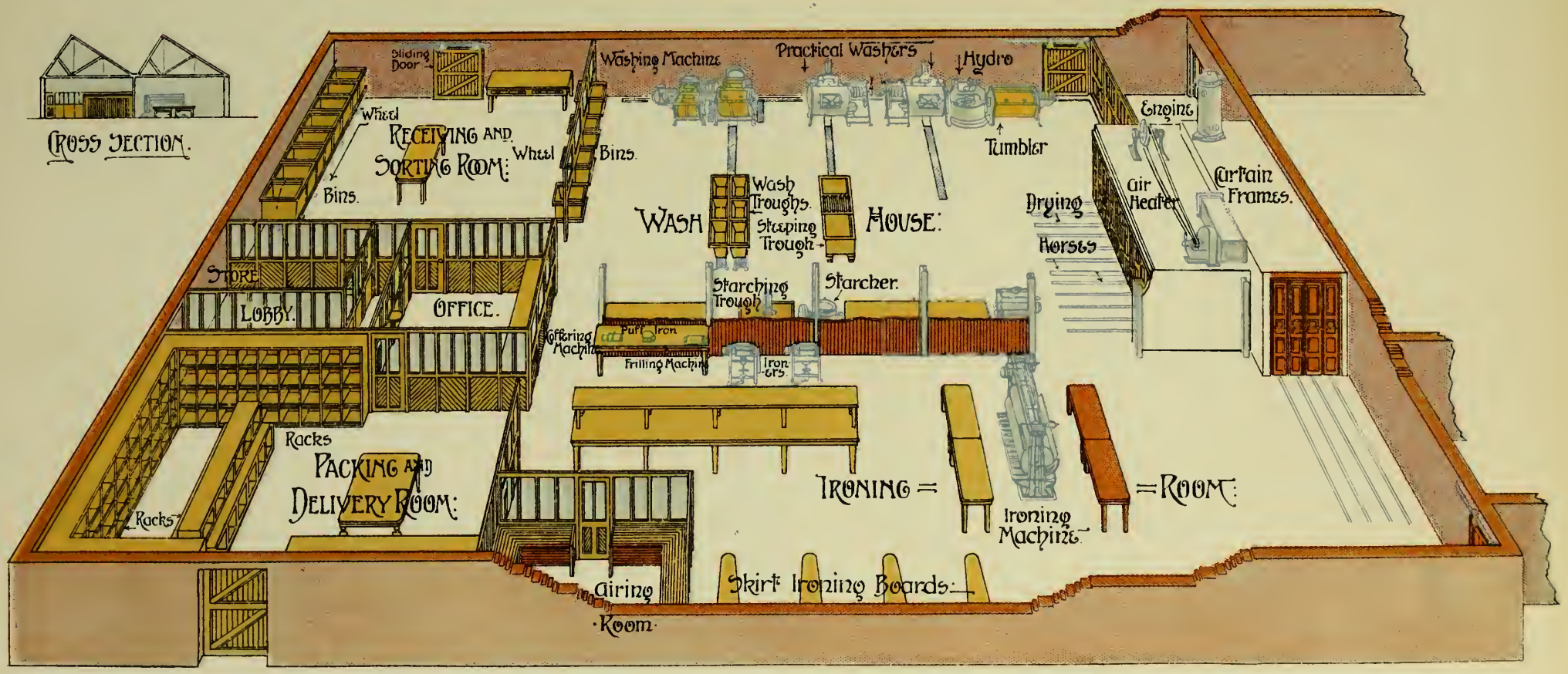
In Fig. 130 the carrier is seen above the delivery station, whilst the despatch platform is on the left-hand side of the illustration. The carrier itself (Fig. 131), consists of an upper and lower wire frame or mechanical fingers, the upper one being fixed whilst the lower is controlled by the curved bar and spring. In Fig. 130 the carrier is seen passing a station, and the framework remains closed ; but where it is required to pick up or deposit cargo the electric current depresses the curved bar, so that it runs along the topmost bar, above the stations, which, on account of its projection, causes the bar to dip and thus opens out the lower finger, so dropping or picking up goods as the case may be. This system is being used for the transmission of book-slips by the Boston Public Library.

The general aim in library equipment should be to so arrange the fittings as to economise space, to make the most of natural lighting, to save labour, and to concentrate traffic.

PLATE III. V.

MODEL SANITARY STEAM LAUNDRY, SOUTHPORT

W. SUMMERSCALES & SONS, ENGINEERS.



CHAPTER X

LAUNDRY FITTINGS

(Contributed by H. C. Quérée)

In a well-appointed steam laundry, such as that erected at Filey (Fig. 132) from the plans of Mr. H. Davis, F.R.I.B.A., or that illustrated in Plate V., both of which were executed by Messrs. W. Summerscales & Sons Ltd., the goods on arrival are checked, booked, special foundations, some of the heavier types of hydro-extractors being of that category, although those now being made are so well balanced that an ordinary floor will safely carry them. In the wash-house there is naturally a great wastage of overflow

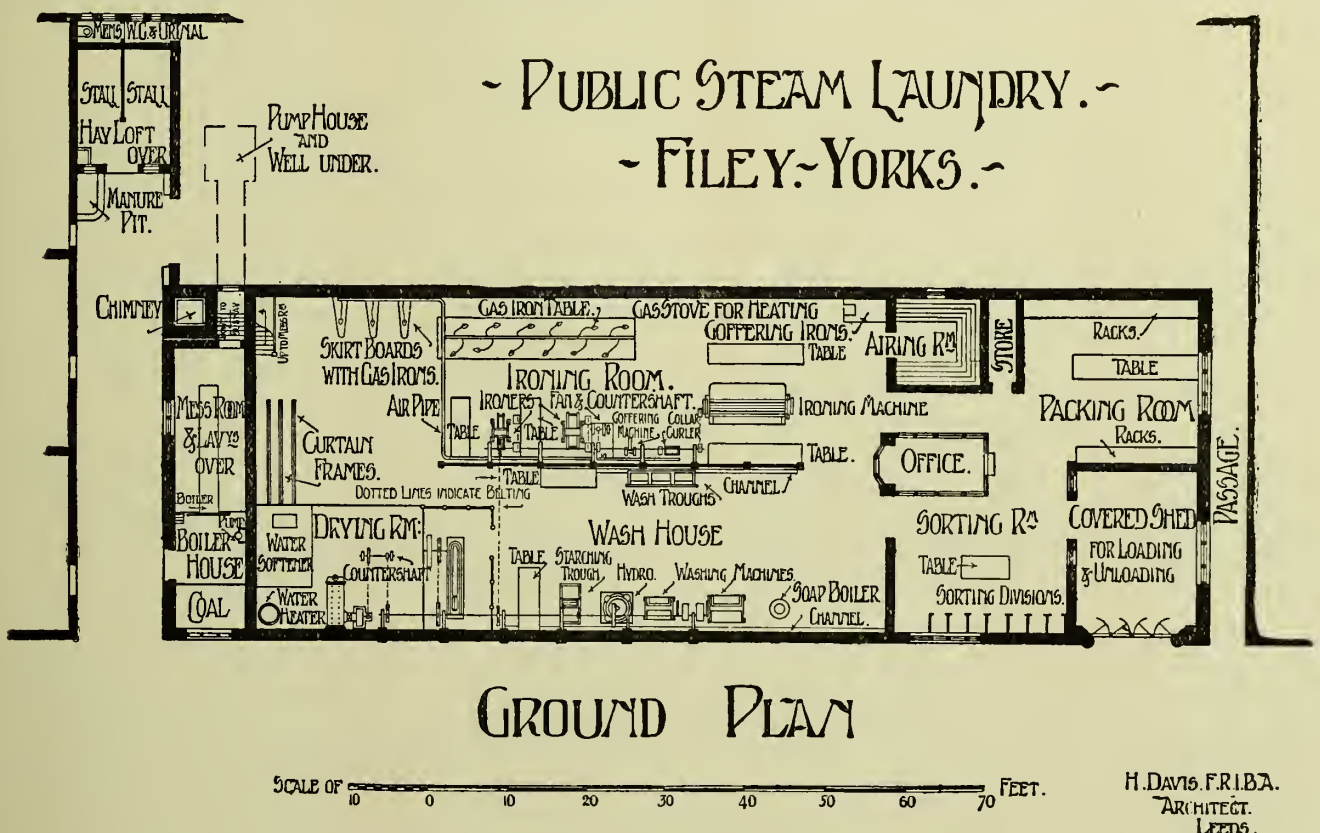


Fig. 132.

marked, and sorted out according to colour and kind of material. Flannels, linens, silks, curtains, etc. are separated and placed in their respective bins, which are made of wood, in number and size to suit the requirements and wishes of the manager. A useful size is 3 feet wide, 4 feet deep, and 3 feet high. Such bins may be constructed as boxes, or may have one side open, as shown in the sorting-room in Fig. 132.

The floor is usually made of good cement concrete, and the architect would be wise to consult the laundry engineers as to whether any of the machinery requires water, and provision must be made to carry this away. The floor should be made slightly sloping towards the sides, so leaving the centre gangway perfectly dry. All drainage within the laundry should be of the open-channel type, smaller gutters leading to the main channel from the outlets of washing machines, hydros, etc. It is deemed advisable that the gutter should empty in a cesspit, where grease, etc., can accumulate and be cleaned out—together with any buttons, etc., which may have got astray in the course of washing. Where objection is taken to this cesspit, the

water may waste into a gulley trap, and so away to the sewer.

The goods, after having been sorted, are then washed and rinsed, in some cases by hand, in others by machinery; silks and curtains, which require great care, being always washed, rinsed, and wrung out by hand till thoroughly free from dirt or spots, when they are boiled and rinsed, either once or more often, and then wrung out and placed in a hydro-extractor which drains out the water. Where the hydro is not used the goods are taken through the wringing machine.

The next step is either to take goods direct to the ironing machine, or to further dry them in a heated room, or by means of specially constructed drying

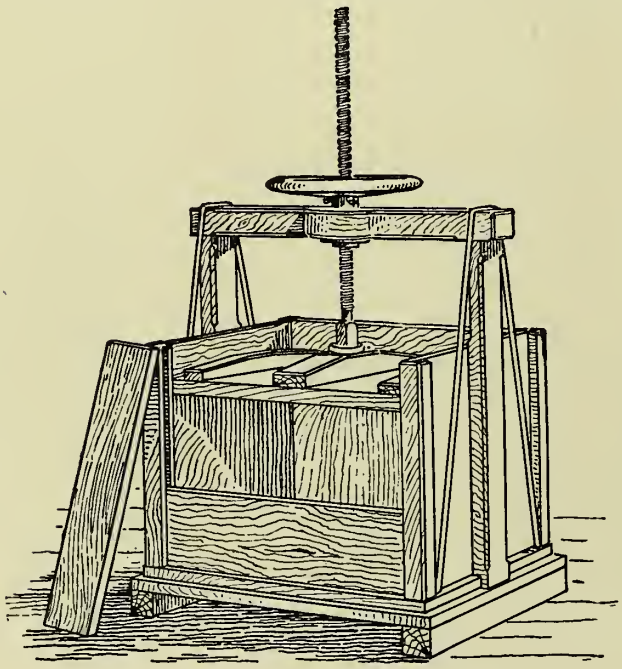


Fig. 133.

closets. Such delicate articles as silk blouses, etc., would probably be hung on rails in the laundry itself, the heat derived therefrom being sufficient for the purpose of drying them.

Where articles have to be blued they are placed, after going through the washing process, in a blueing machine, or left in the washing machine and blue added to the boiling water. In some laundries it is preferred to do this by hand, by immersing goods in a trough built of brickwork, lined inside with white glazed tile and outside with wood sheeting.

As to starching, there are two processes in vogue, but that which has been most generally used in England is known as the raw-starch process, in which, as the name implies, the starch is used in an uncooked state. After its application the goods are taken to the hydro, where the moisture is, to a great extent, extracted; and, whilst still wet, they are passed on to the ironing machine to be finished, the starch being thus cooked under the hot roll of the machine; for it is essential that the starch should be cooked at some time during the operation, so as to give the glazed finish to starched goods. The boiled-starch process is largely used in America, and is being adopted by our newest laundries. In this case the starch is put into the linen ready cooked, and the goods are then placed in a box-like press which extracts any surplus starch, and are then dried, and again passed into another press (Fig. 133), which dampens the goods before they are finished in the ironing machine.

The goods, having gone through their complete re-cleansing process, are sent to an ordinary large-sized table, where the forewoman examines them as to their cleanliness, finish, etc., and if satisfied forwards them to another table, which must be of good capacity, from which they are taken to packing tables, preferably in a separate packing-room (see Fig. 132), sorted out and placed in wall racks, each customer having one or more racks according to the quantity of goods sent. These racks are made of wooden uprights and battens, and may be of any size as required; but a compartment, 2 feet 3 inches wide, 2 feet 3 inches deep, and 1 foot 6 inches high, will be found convenient.

The Filey Laundry, which may be considered as a typical one, cost £2541 exclusive of site, but inclusive of buildings, machinery, well-sinking, pumps, and water softener.

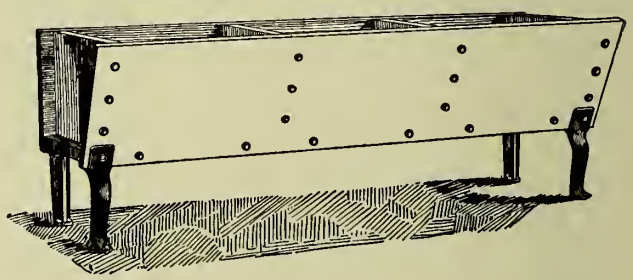


Fig. 134.

In laundries in connection with hospitals, asylums, and other such public institutions, where it is essential that all goods should first of all be thoroughly disinfected, special machines are provided. For ordinary laundries, however, this does not apply.

Hand-Working Appliances

Washing appliances may consist of anything from the ordinary well-known wash tub to the revolving machine. Wash troughs, finished in white porcelain or cane glazed, may be fixed against the wall on strong brackets, or supported by iron standards in the centre of room. Glazed troughs may also be placed on brickwork if so desired. Troughs are also made of 2-inch pitch-pine well framed together, supported by wooden or iron legs, as in Fig. 134, made 2 feet 4 inches long, 2 feet 1 inch wide, and 1 foot 5 inches deep, for each compartment. The total height from floor is 2 feet 8 inches. It will be obvious that

it adds greatly to the convenience if it is possible for a hot and cold-water supply to be laid on to these tubs, with all waste plugs, etc.; but in an ordinary small laundry the water would probably have to be boiled in a "copper" boiler, either set in brickwork or detached, like Cakebread, Roby & Co.'s "Jack Horner Copper," with a cold-water supply and draw-off tap provided. Where machinery is used, washing troughs are necessary in which to wash a small amount of clothing which has to be delivered at an earlier time than would be required were it to go through the ordinary process, and also for re-

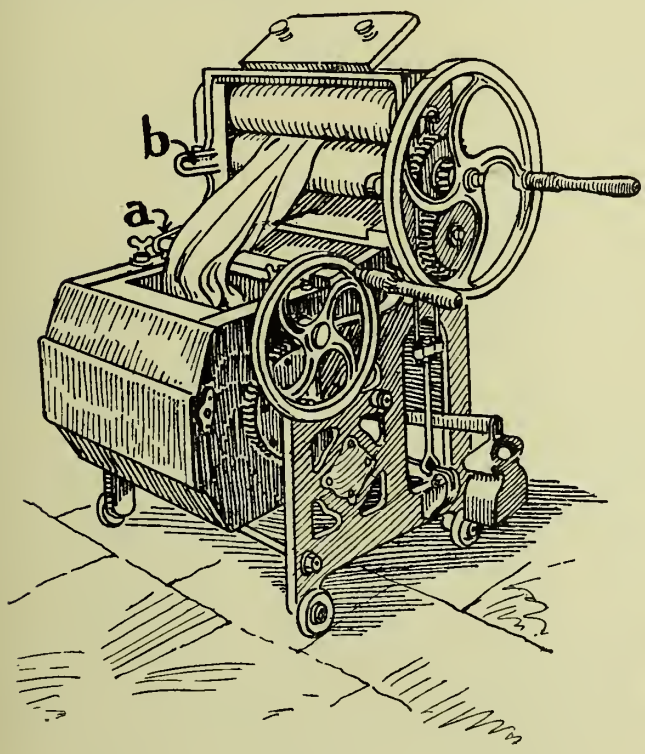


Fig. 135.

washing any article which is still dirty when taken out of the machine, or which may become dirty in some other way. It will thus be seen that several troughs are necessary, the number being entirely regulated by local circumstances and the ideas of the manager. Some laundries use three or four, and others double that number. Where the requirements are large, naturally these troughs will have to be multiplied.

Those clothes which are not to be trough washed are placed in some apparatus similar to that shown in Fig. 135, and of which there are several other forms. The "Vowel" washing machine (Fig. 135), by Messrs. Bradford & Co., is composed of only the one case which revolves, and is shown in position for the wringing operation. The drip board at *a* is placed so as to carry the water which is wrung out of the clothes back into the washing compartment. For mangling, the washing compartment is inverted, so forming a table, whilst the drip board is raised to the upper grooves (*b*). The rollers are made of sycamore wood, and pressure is regulated by means of a weighted lever.

It would, in some cases, be a waste of good soap-suds to empty the washing machines and fill again with clean water to rinse clothes, and then again to discharge and fill with boiling water to boil and blue, so it is found more economical to have separate troughs for these purposes.

Fig. 136 illustrates a trough made in two compartments, one for rinsing and the other for blueing, with a drawing board between. These are made by Messrs. Summerscales, 2 feet 9 inches wide and 2 feet deep, and either 6 or 7 feet in length, and are of pitch-pine mounted on cast-iron feet. The troughs are also made in single compartments, 2 feet wide, 2 feet deep, and 3 or 4 feet long. Hot and cold-water service with waste plugs may be fitted to these troughs.

Starching is done in a trough of some description, such as that illustrated in Fig. 137, made in pitch-pine

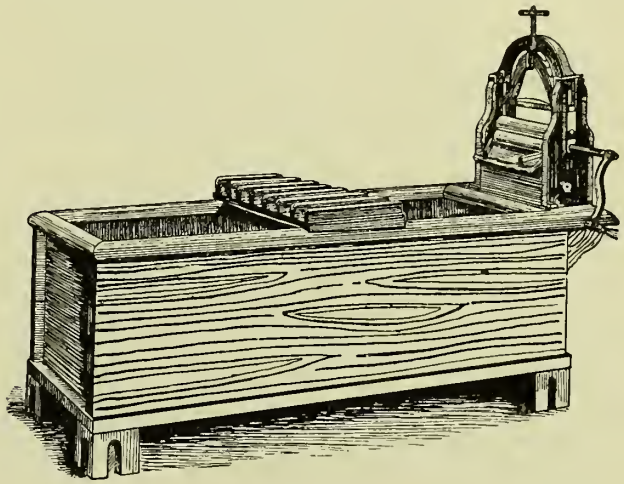


Fig. 136.

and in two compartments. This is convenient, as it may also be used both as a rinsing and blueing machine, and may be fitted with one of the movable wringers. The floor space required is 4 by 3 feet.

Articles having been washed, blued, starched, etc., are then placed in a machine which takes away most of the water from them. This machine, called a hydro-extractor (Fig. 138), consists of a perforated basket of galvanised steel wire or copper, which is top hung, revolving round the rim of a cast-iron outer casing. The gear for causing it to revolve is enclosed in the cast-iron case at side, which is provided with lubricating spouts and a lever to set the machinery in motion. These machines require from 3 feet 6 inches by 3 feet to 4 feet by 3 feet 6 inches of floor area.

Goods which simply require a mangle finish are found just sufficiently damp, on leaving the hydro-extractor, to be run through a roller mangle such as that illustrated in Fig. 135. Large pieces, such

as sheets or tables-clothes, for which no gloss is required, may be placed in what is known as a box mangle (Fig. 139). This consists of a solid heavy framework with a box, heavily loaded with stone or other ballast, which travels to and fro, and is supported by two rollers which in their turn roll along the bed, generally of mahogany. The roller is removed from under the box by means of a small steel tongue (*a*) placed on the centre bar, which on being lowered causes the small roller (*b*) to travel up its incline, so raising the box and removing weight from roller. A table is generally placed near to this machine, and the mangle cloth laid on it. The goods are then placed side by side on this cloth, and then wound round the

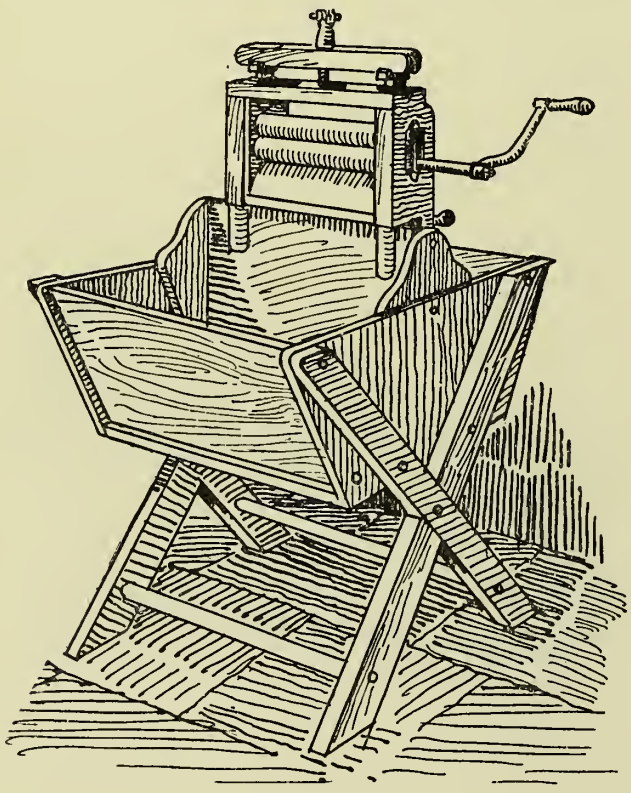


Fig. 137.

roller, which is run along the table by the operator, thus winding the cloth and goods round it. The roller is then placed between box and bed, when the machine is set in motion until the goods are sufficiently finished. Three rollers are generally supplied, so that while two are in use under the mangle, the third roller is being filled with material. These box mangles are still used, but are gradually giving place to the ironing machines, and many laundries are without them. The following table gives the sizes :—

Size of Bed.	Floor Space Required.
5.0 × 2.9 . . .	7.9 × 3.9
6.0 × 2.9 . . .	9.9 × 3.9
7.0 × 3.0 . . .	11.9 × 4.0
8.0 × 3.0 . . .	14.0 × 4.0

Hand-Ironing Appliances

The next process is that of ironing, and the tables, irons, etc., to obtain a satisfactory result should be fed with a supply of gas and air, which mix together by means of special mixing valves or cocks. Gas is said

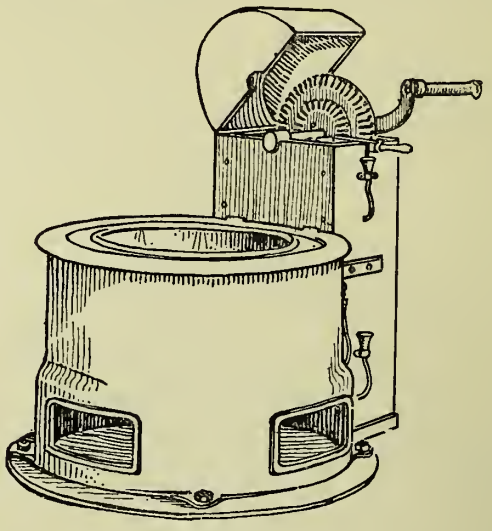


Fig. 138.

to be the only means by which to get the required sharpness of heat ; when gas is unobtainable a substitute is found in a gasoline generating machine. The generator is filled with gasoline at 88° gravity, and a compressed air service is connected to the apparatus,

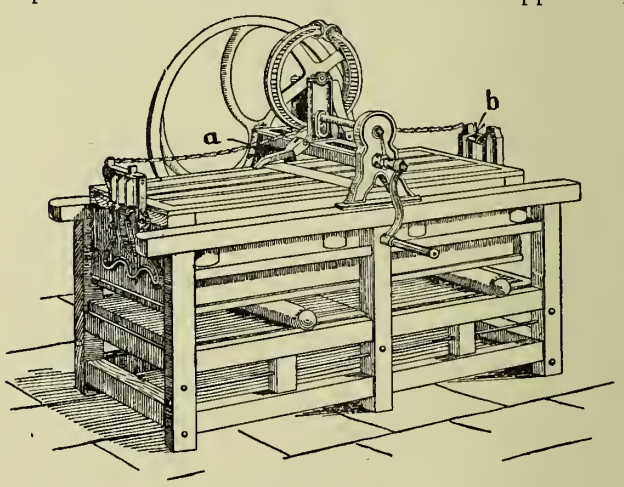


Fig. 139.

which drives the gasoline through the pipes to the machine required to be heated.

The ironing machine for such goods, as table linen, handkerchiefs, etc., is illustrated in Fig. 140. The revolving roller is covered with a specially manufactured felt. This is heated and presses the goods between itself and a heated highly polished steel concave bed below, being regulated by pedal action. Floor space required is 3 feet wide by 4 feet 8 inches to 5 feet 6 inches long.

A shirt ironer is shown in Fig. 141, occupying 3 feet 3 inches by 3 feet 6 inches floor space. The roll is heated and revolves; and at the same time the board, clothed in a sort of blanket sheeting, moves backwards and forwards. Besides shirts, collars and cuffs may be ironed on it.

If ordinary irons are used, then wooden tables would be best, such a table as that shown in Fig. 142 offering advantages for shirts, etc. Several of these are provided for in the Filey Laundry (Fig. 132). Special tables are also made for shirts in which a shaped board slides out to take a shirt front.

Power-Driven Appliances.

Flannels are often washed by hand in glazed earthenware troughs, or else in power-driven machines such as the "Williamson," which is made of pitch-pine carried by an iron framework. The action of the machine is to alternately press and loosen the flannels placed between the two corrugated surfaces *a* and *b* (Fig. 143). The

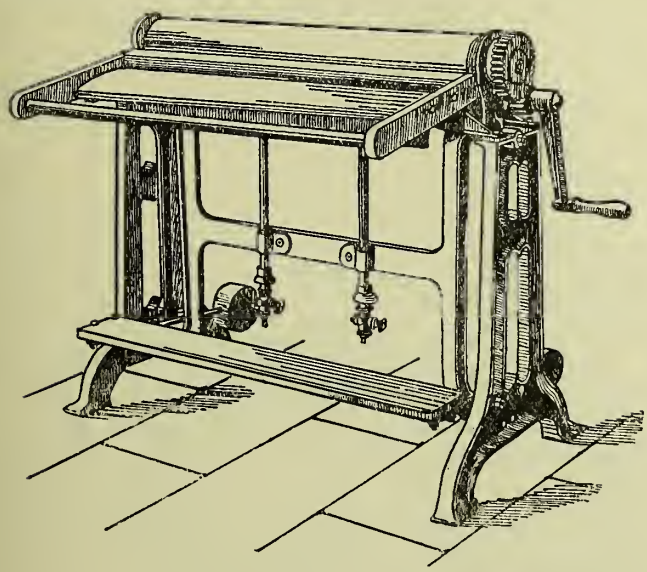


Fig. 140.

press *a* works like a pendulum to and fro. Both sides of machine are alike, therefore whilst one set of flannels is pressed the other is loosened. The spring board *b* gives way slightly to the pressure exerted by the press *a*, as it is connected to india-rubber springs *d* by means of the crank arm *c*.

Floor space required is as follows:—

Size of Machine. Ft. In.	Floor Space. Ft. In. Ft. In.
4 0	6 9 × 3 6
4 6	7 0 × 4 9
6 0	8 6 × 4 9

The linens are washed in wooden or metal machines driven by whatever motive power is being used. Whatever the machine is made of, it is composed of two cylindrical cages, one within the other, each fitted with a door opening. The inner cage is perforated, and revolves, but to prevent the roping of clothes the action is automatically reversed.

Washing machines are, however, made of such numerous patterns and sizes that the area required for

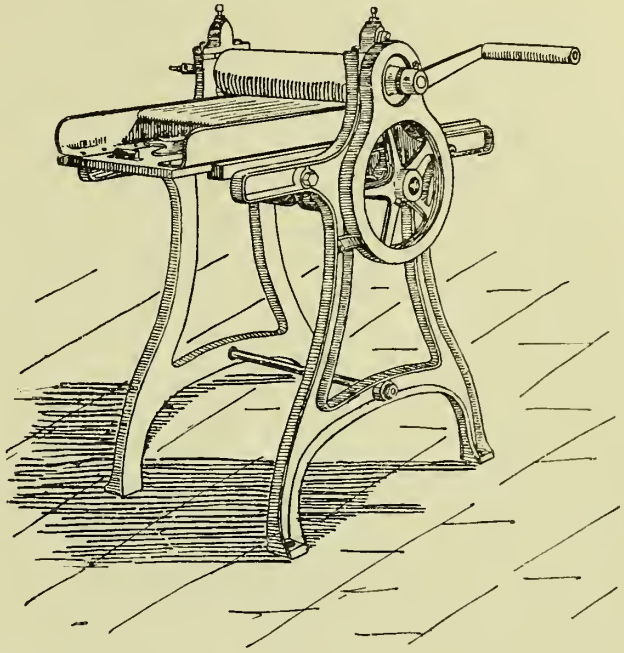


Fig. 141.

their accommodation may be anything from 2 feet 6 inches by 4 feet 9 inches to 6 feet 6 inches by 5 feet.

For clothing which is specially soiled, machines are made which both purify and cleanse; such is that of Messrs. James Armstrong & Co. (Fig. 144), which takes a floor space of 3 feet 6 inches wide and 7 feet or 8 feet 9 inches long. This machine is made in the ordinary way, with the addition of a ventilating pipe, either connected with a chimney or else carried into the open air, which carries away all odours and impurities.

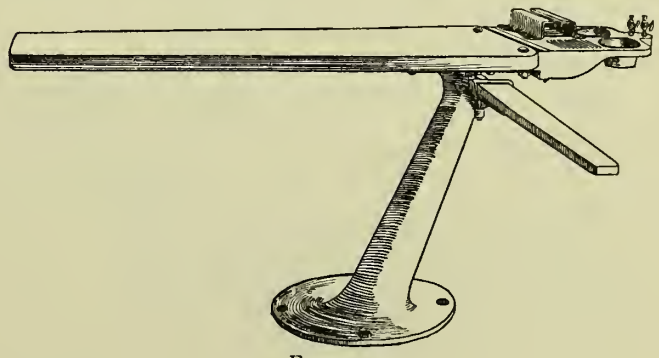


Fig. 142.

For washing machines, the soap and soda is used in liquid form. A dissolver (Fig. 145), made of galvanised wrought iron fitted with steam perforated coil, boils the soap and soda, and prepares the liquor for further use. Such a tank occupies approximately a space of 2 feet 6 inches by 2 feet 6 inches.

The hydro-extractor in which the liquid is drained from the clothing is, when power-driven, composed of two cages, the outer one made of cast iron and the

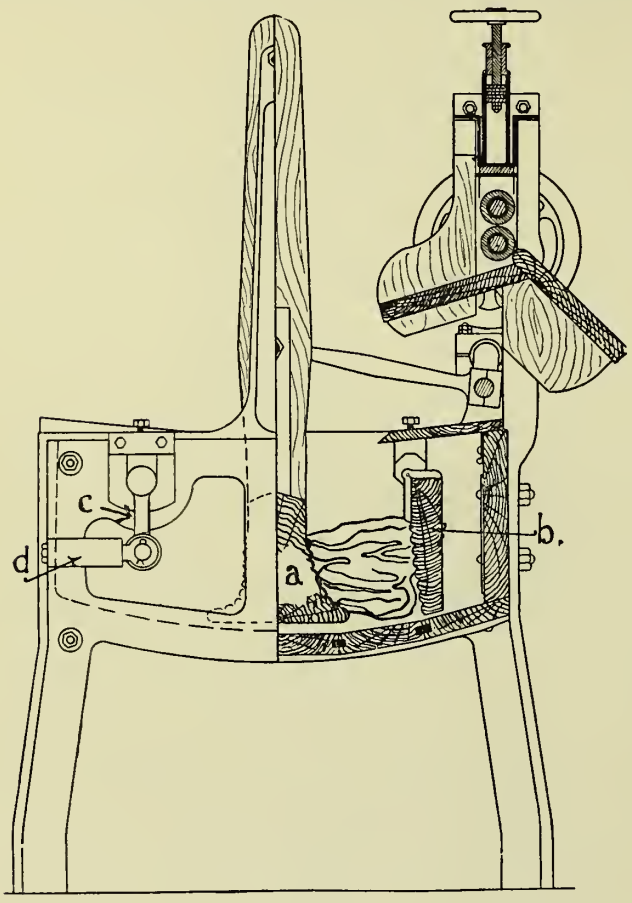


Fig. 143.

inner one, or basket, either of galvanised steel, copper wire, or of perforated brass or copper.

The clothes are packed in the inner basket, and are

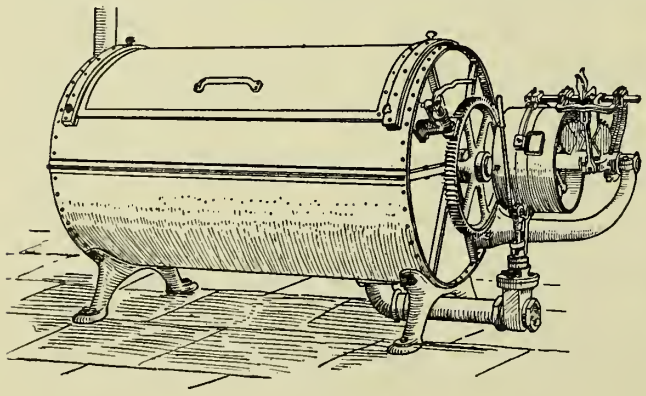


Fig. 144.

thus revolved at a high speed, on an average of 400 revolutions a minute; but some machines run as rapidly as 1100 revolutions, the water draining off through a spout at base and the machine being rotated till water ceases to flow. The hydro is made to be driven in all manner of ways. The belting is connected to hydro, in some cases direct, and rotates the machine by means of a friction cone.

This machine occupies an average floor space of 4 feet 6 inches square.

The Tumbler machine is one which supplies the mechanical assistance for a complete machinery outfit. Fig. 146 represents one made of pitch-pine with cast-iron frame. Unlike the washing machine, it is com-

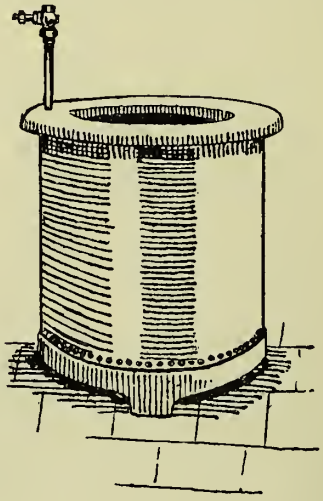


Fig. 145.

posed of one cage only which rotates. It is made by Messrs. Summerscales in three sizes:—

Size Cylinder.	Floor Area.
Ft. In. Ft. In.	Ft. In. Ft. In.
6 0 × 3 1 . . .	9 0 × 3 4
5 0 × 3 1 . . .	8 0 × 3 4
4 0 × 3 1 . . .	7 0 × 3 4

and the height in each of these three cases is 4 feet 6 inches.

Wringing machines need little explanation. Figs.

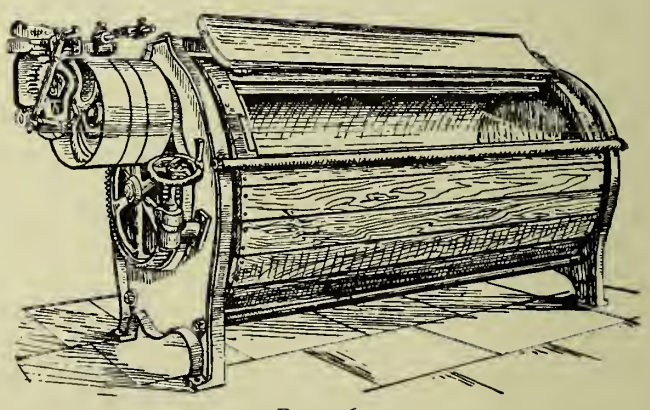


Fig. 146.

136 and 137 supply the idea, which is that of a pair of rollers made of sycamore wood or of indiarubber. They may be fitted on a table or have their iron stand, in which case a space of 2 feet by from 4 feet to 5 feet would have to be provided.

The starching is often done by hand in a trough, something after the style of the rinsing trough shown in Fig. 136, but of lesser length. The different designs of machine-starching apparatus are too numerous to

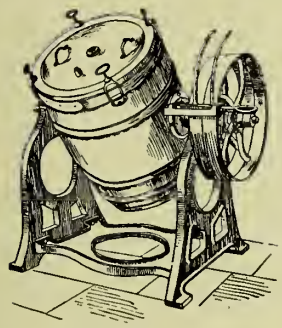


Fig. 147.

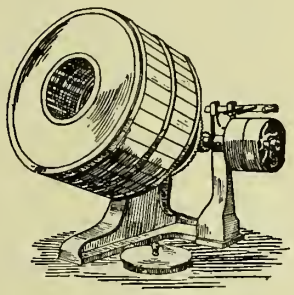


Fig. 148.

enable a description of each being given within the scope of this work. Fig. 147 shows a barrel-shaped machine which revolves in both directions. Floor space 3 feet 8 inches by 1 foot 10 inches, height 3 feet

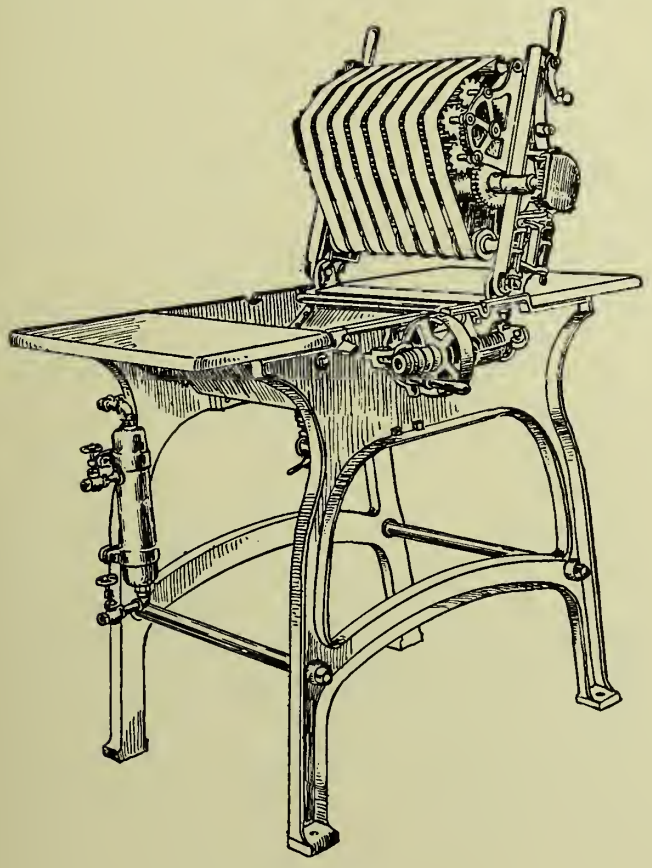


Fig. 149.

8 inches, while Fig. 148 represents a patent device of Messrs. Hill & Herbert. It occupies space according to size, varying from 3 by 2 feet to 4 feet 9 inches by 4 feet, and is so made that the cover can be easily lifted and goods removed from or placed into the machine without its revolving action being stopped. These machines are also used for washing flannel.

For shirts, collars, or cuffs, where boiled starch is used, special machinery may be employed, the principle being to well rub the starch—which should be always kept boiling—into the linen. Fig. 149 shows a collar and cuff starching machine made by Messrs. Armstrong & Co.

The tank is steam-jacketed, and consists of several corrugated rollers, between which the tapes pass and guide the collars through. By this means the starch is pressed into the collar, the friction being entirely on the sets of tapes which enclose the collars, and all surplus starch being squeezed out as the collar passes out between the last two smooth rollers. The apparatus requires a floor space of 3 feet 3 inches by 4 feet.

With an uncertain and variable climate such as ours it would be impossible to keep the ironers supplied with dry articles of clothing, etc., were it not that aid is forthcoming by mechanical means. For effecting a perfect drying it is necessary to have heated air, which takes unto itself the moisture from the clothes and then passes on. Clothes may be dried before an open fire, but this is both dangerous and unsatisfactory; or they may be placed in some room which is heated by steam coils or other system. This separate room is adopted by many laundries, as is also that of draw-out horses, which either run on iron girders at their base or are hung with pulleys on rails above. These horses are made 9, 12, 15, 18, or 22 inches wide, and are of cast-iron fronts and galvanised wrought-iron plate

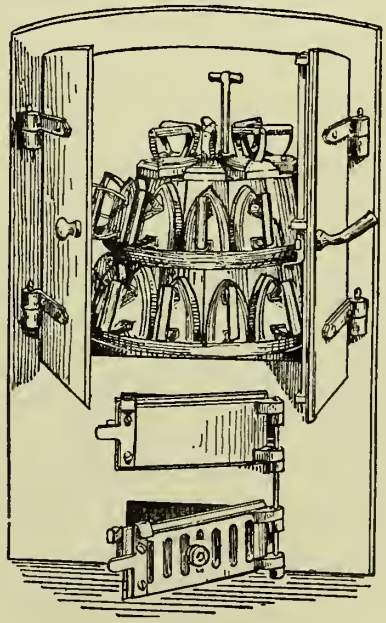


Fig. 150.

backs, connected together by hollow galvanised iron rods. These horses may be kept together by means of a cast-iron frame, or else built up in a brickwork chamber. Where elaboration is allowed, the fronts of horses may be finished off with mahogany or other panelling, a non-conducting material being placed between this and the metal.

In laundries where hand-power machines are in use, and steam not obtainable, a convenient way of heating the horses is to build up in the centre of them a stove such as that shown in Fig. 150. The heat may be conducted from this furnace to under the horses by means of iron ducts, or simply allowed to make its way out at top or wherever convenient. The stove, which is 4 feet by 2 feet 6 inches in size, may be used for heating flat irons, as shown. Instead of this stove an ordinary coal furnace may be used in the same way, or, if more convenient, may be placed in a pit below. The stove or furnace may be used to heat ordinary brick built chambers, fitted with iron doors and frames. A convenient method, where practicable, is to have a double set of doors to these chambers, one opening into the wash-house where the wet goods enter, and the other into the ironing-room where dry goods will be received.

Where steam is used the advantages derived from it should be made use of.

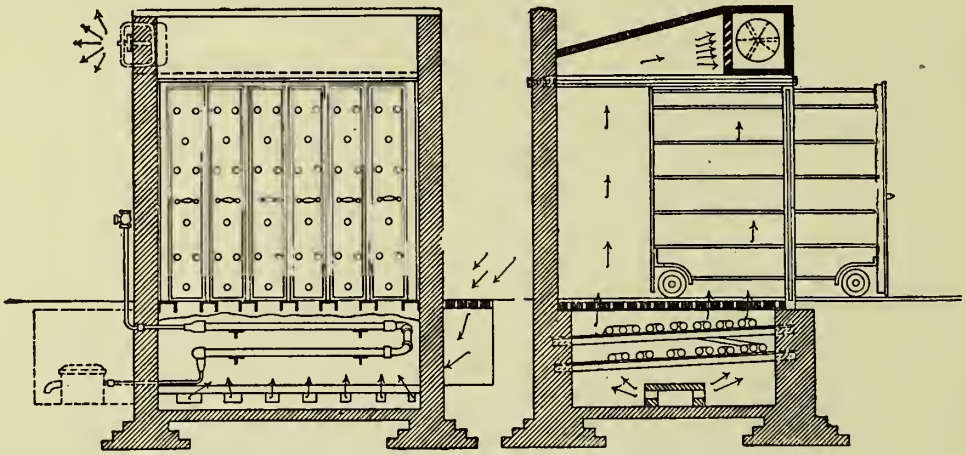


Fig. 151.

The fresh air may be introduced through a duct (see Fig. 151), whence it travels over steam pipes, becomes heated, rises through the perforated grating which forms the floor of the hot chamber, and makes its way through the articles hanging on the rails of the horses, and so on into a flue at back of chamber, whence it is drawn by natural draught into any chimney which may conveniently serve the purpose. It will here be seen that the effective working depends on the strength of the breeze which indrives the fresh air, or solely on the suction power of the chimney. To improve upon this a revolving extraction is often placed at the outlet, making the action of the circulating air much more regular and dependable. Still more effective is the circulation where the air is drawn into a heater (Fig. 152), which consists of steam-heated tubes. The air being thus warmed is forced, by a belt-driven propeller, into the air-duct (see Fig. 151) and away through the outlet. The heating appliance is placed wherever convenient at that side or back, or even above the drying closet should economy of space so require. The space

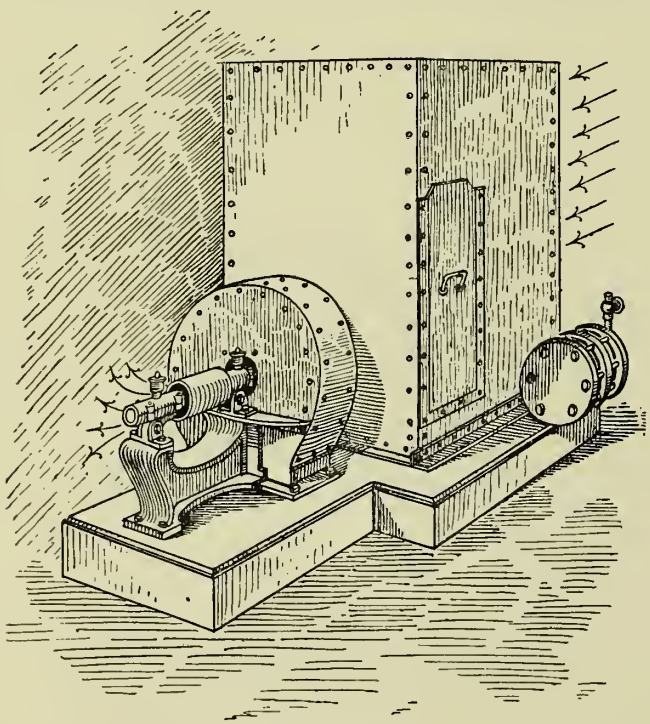


Fig. 152.

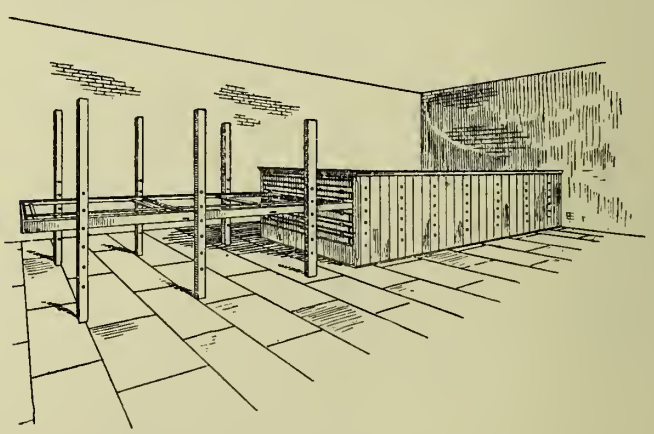


Fig. 153.

required for such a heater would be 7 feet long by 4 feet 9 inches wide by 5 feet high. The fan may be driven by a belt or else have a direct-acting steam engine or electric motor affixed thereto. It may be remarked that the heater is often used to draw the air from the heated ironing room, which, after its course over the horses, makes its way, still warm and sufficiently dry, into the washhouse, so effecting an inexpensive mode of ventilation.

Curtains, being of an extremely delicate nature, are fixed on a framework, and may be dried in a horizontal box such as that illustrated in Fig. 153, when the heat would be obtained from steam coils. The space required, including draw out, is 35 by 10 feet.

Power-Driven Ironing Machinery

Table linen and other large flat pieces are ironed in one piece on a large machine. This consists of a concave bed of highly polished iron (see Fig. 154) heated by steam or gas and air. In this bed revolves

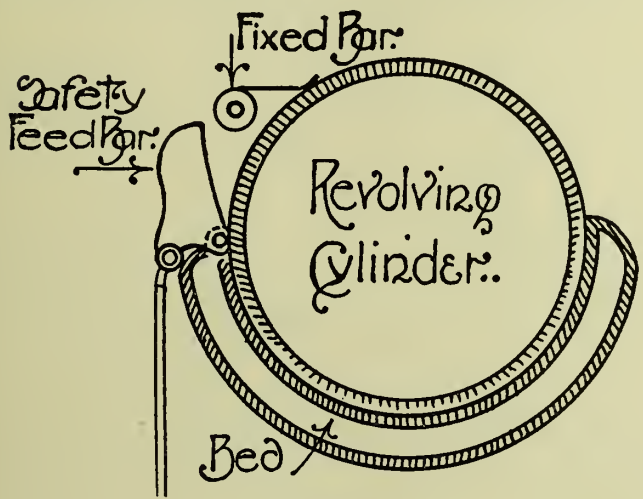


Fig. 154.

a heated roller, clothed in flannel and calico sheeting. The article to be ironed is placed in the feeding bar, whilst the fixed bar is so placed that it is impossible for the finger of the attendant to become jammed by the roller. When the cloth is in place the feed bar is pressed against the roller by pedal action, and the cloth travels between roller and bed, and so out on to a receiving table of polished oak on the other side. These machines are generally placed at right angles to the main shaft, but are made to be driven in any position, as also by an independent electric motor.

Size of Roller.					Length.	Width.	Height.
Ft.	In.		Ft.	In.	Ft. In.	Ft. In.	Ft. In.
12	6	×	3	6 diameter.	16 10	7 6	4 7
10	0	×	2	0 ,,	13 6	6 0	4 0
9	0	×	3	6 ,,	12 9	7 6	4 7
9	0	×	2	0 ,,	12 6	6 0	4 0
8	4	×	2	0 ,,	11 10	6 0	4 0
6	8	×	2	0 ,,	10 2	6 0	4 0
6	0	×	1	4 ,,	8 10	4 10	3 9
5	0	×	1	4 ,,	7 10	4 10	3 9

In many laundries ironing machinery is used for flat goods alone, the shirt bodies, etc., being ironed by irons fed by forced air and gas, mixed together by an air mixing cock which connects the pipes to the flexible metallic tubes which feed the irons. Fig. 155 gives an

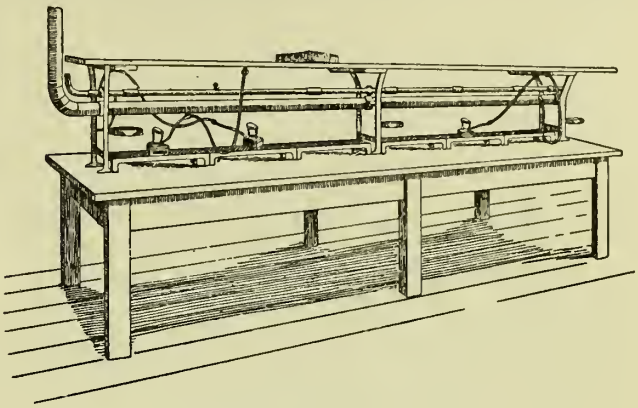


Fig. 155.

illustration of such an installation. The width of table would be at least 5 feet for ironers on each side, and with advantage could be 6 feet, whilst the length would be regulated by local requirements.

A collar and cuff ironing and finishing machine is,

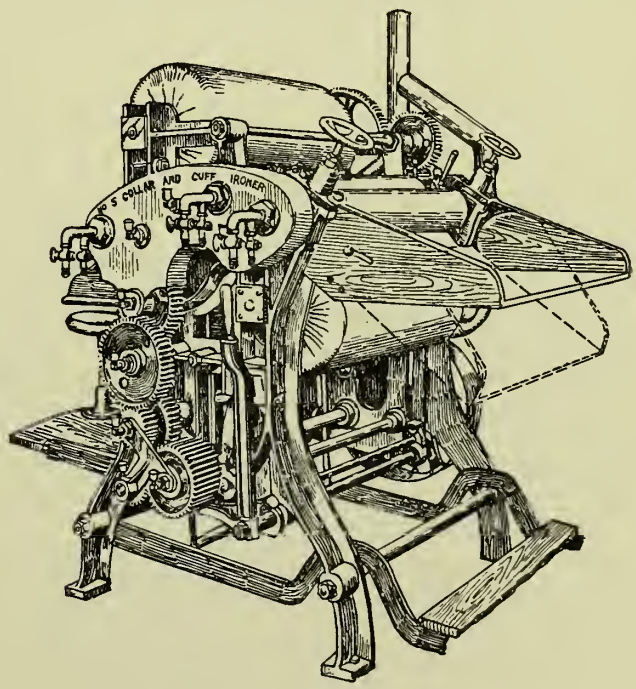


Fig. 156.

however, used in most laundries of ordinary size. Fig. 156 gives one of some capacity which could with advantage be used in laundries which do a trade of £100 or more, or where a large collar business is carried on, occupying 7 feet 6 inches by 5 feet 6 inches floor space. It is built with two, three, or five metal rollers 24 inches long, heated with gas and air.

A shirt ironer (Fig. 157) is so made that a raised and sliding table is provided on which the bosom of the shirt is placed. It is then passed under the heated metal roller. Space required, 4 feet 6 inches by 2 feet 6 inches. The table is repeatedly passed backwards and forwards by hand till the shirt front is sufficiently finished.

Neck and wrist-bands of shirts have their special apparatus, taking up 2 feet 10 inches by 1 foot

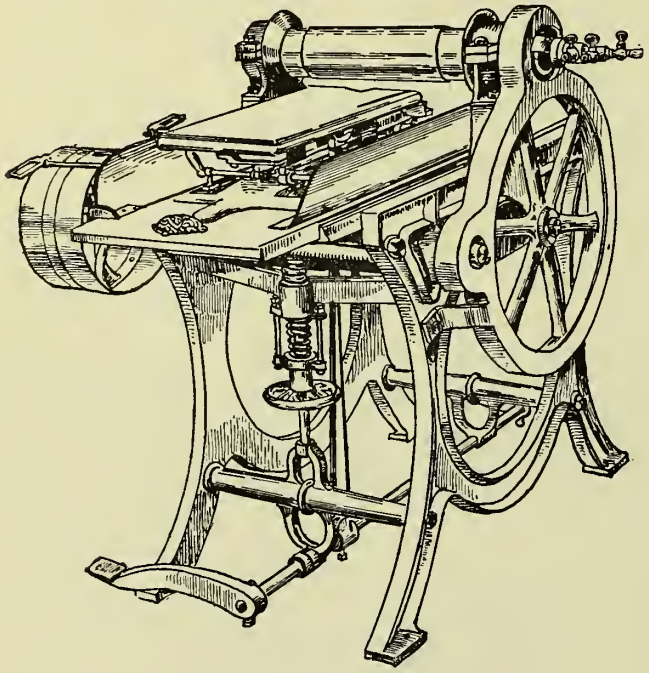


Fig. 157.

8 inches space; whilst sleeve and yoke ironers are much of the same pattern, but with longer rollers and occupying 3 to 4 feet by 1 foot 8 inches floor area. The edges of collars or cuffs may require smoothing, and this is effected by first dampening them over a padded roller placed in a small water tank. The collar edge is then placed to and fro in one of the grooves of the steam-heated chest. This appliance may also be used for folding double collars.

For collars and cuffs to be perfectly finished they must be curled into shape by another special machine, which is as a rule placed on a table, and is 2 feet long by 10 inches wide. It consists of a $2\frac{1}{2}$-inch diameter indiarubber roller, and a polished steel roller which has a greater speed than the rubber roller, and so curls the collar or cuff.

A body ironer (Fig. 158) is used for ironing handkerchiefs, underwear, shirts, bodies, and similar articles, and as usual consists of two rollers, one clothed and the other polished. In some machines of other makes the heating surface, instead of being a roller, is a fixed metal chest under which the other roller rotates. This machine occupies 5 feet 3 inches by 2 feet 9 inches floor

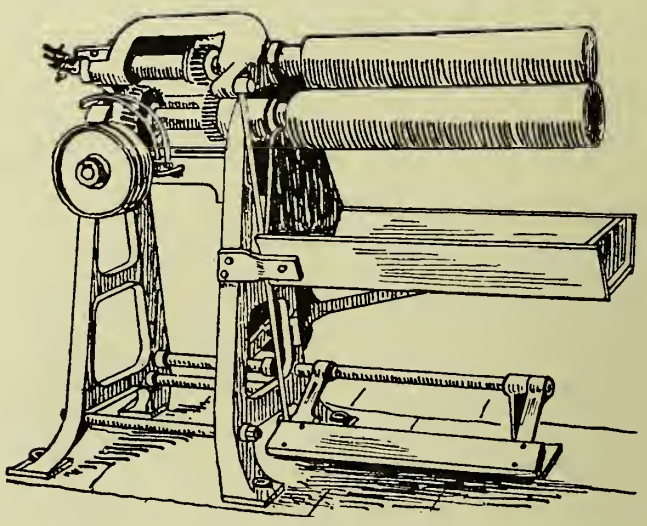


Fig. 158.

space, but larger machines require 7 feet 6 inches length.

Goods requiring fluting or goffering are run between two corrugated or fluted metal rollers, both of which are heated. The space required is 18 by 15 inches. This apparatus may be placed on a table if more convenient.

Several tables would most probably be required, being placed at right angles to the wall as shown in the plan of the Filey Laundry (Fig. 110).

PLATE ~~IV.~~ VI.

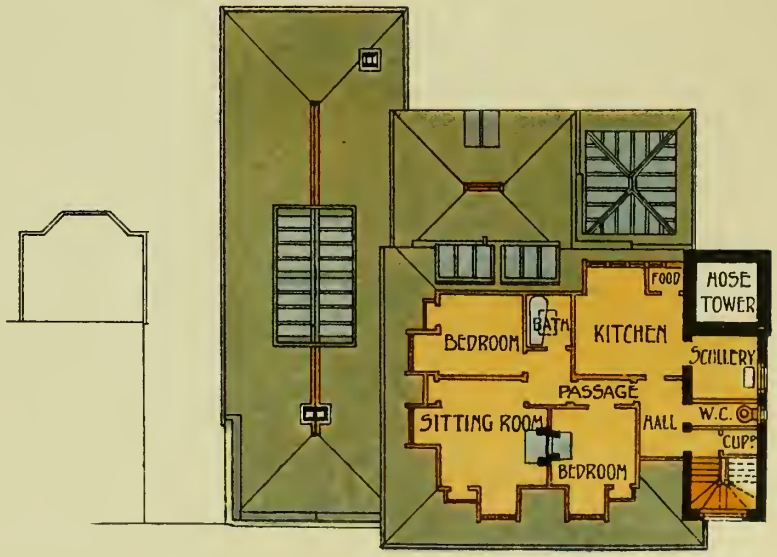
ALDERSHOT FIRE STATION

C.E. HUTCHINSON ARIBA
ARCHITECT

FRONT ELEVATION

Scale of Feet
10 5 0 10 20 30 40 50

GROUND FLOOR



FIRST FLOOR

CHAPTER XI

FIRE STATIONS

(*Contributed by* HEDLEY C. QUÉRÉE)

THE pride and aim of a Fire Brigade is to arrive at the scene of conflagration as quickly as possible from the time that the call has been sent in. The method of call differs largely,—in some cases it is received at the police station and then transmitted to the chief officer, but in the majority of cases the call is sent to the fire station direct, and this is certainly the most logical method where a fireman is continually on duty. In a well-equipped station, such as that at Aldershot, designed by Mr. C. E. Hutchinson, A.R.I.B.A., and illustrated in Plate VI., it is customary for the chief officer to have his house on the premises, in which case his living room can sometimes serve the purpose of call office, though it is better to have a special room devoted to the purpose, as at Aldershot. There is again the question of firemen. In London these frequently live in their own quarters on the premises, and are continually within call, except when away on special leave. In the provinces, however, this is different, as the cost of such a permanent establishment would not be justified by the number of turn-outs. Here the men would be located in houses in the neighbourhood, and be employed under the Corporation or by such firms as would have no objection to the men leaving when a call to attend a fire was received. It thus follows that the London Brigade and those of other large cities have the advantage of turning out in quicker time than provincial brigades; although in all stations the aim should be to have everything in connection with horses, engines, and men in such a state of readiness that no unnecessary time will be wasted, and all so fixed that there will be no confusion or cross traffic.

Let us briefly follow what takes place in an electrically fitted Metropolitan Fire Brigade Station. The call may come from the street alarm well known to most of us, which gives the following information —"Break the glass, pull knob, wait for engine," or else from such as (Fig. 159) where, as soon as the glass is broken, a bell automically rings in the station, and the indicator shows from which post the alarm comes. A call may also be received from one of the neighbouring stations, or from any public institution, such as a hospital, asylum, theatre, etc., or from any building which may be in direct telephonic communication with the fire station. On hearing the bell the duty man at once goes to a board (Fig. 160), attends to the telephone message, resets the automatic push, and at the same time pushes an electric button which sets call bells ringing in each of the firemen's dwellings. This board contains a separate push-button for each man should he only be required. A switch is also provided to cut off the current when a fireman is not to be called out on duty.

The pressing of the button would act on electric magnets placed on the station and stable doors,

FIG. 159.

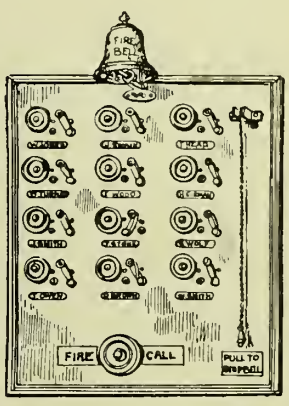


FIG. 160.

which would release the bolts and allow the doors to swing open by means of springs. The horses, trained to their work, set themselves free by the forward movement and rush to their places, one on each side of the engine pole, above which the collars, traces, and reins are suspended—the horses being always ready bridled when on duty, and the stalls being so planned that the horses stand facing doors which open direct from their stalls to the engine house (see Plate VI.). The firemen, in the meantime, on hearing the call bell, have donned their garments, and, if resident on the premises, have ascended by the staircase or slid down the brass pole, leading from the upper to the ground floor, where they go to their respective hooks, put on their uniform, helmet, top-boots, belt and axe. The collar is then fixed over the horse's neck and secured

by a patent spring lock, the men jump on the engine, the driver shakes out the reins, and the horses gallop out of the stations after a very short interval from the time when the call bell was rung. The horse or hand escapes would follow in turn as they were required.

To return to the duty man, whom we left ringing up the firemen. He would pull the cord to stop the ringing of the call bell, ring up the head stations of the adjoining districts and local police station, sending telephonic messages as to the locality of fire, and would if necessary at the same time send a message through to headquarters.

The procedure in a provincial fire station is the same in principle, but may differ in detail. In all cases the telephone-call apparatus would be connected with each man's dwelling, but the fireman would come ready equipped with helmet, belt and axe. In London, horses are continually kept on the premises ready for a turn-out, whilst in a provincial town, where there may be only one or two dozen calls in a year, it is not feasible to adopt this plan, and an arrangement is generally agreed upon with a job-master so that the required number of horses for steamer and escapes, with their respective coachmen, will always be supplied when required. For this purpose the telephone apparatus is so arranged that the alarm bell may be caused to ring in the coachmen's rooms; and they generally sleep on the stable premises when engaged for this special work.

In many of the provincial towns, such as Exeter, Stafford, etc., the water supply is quite sufficient, in both quantity and pressure, for it to be allowable to connect the hose to the hydrant direct, and therefore the steamer is only requisitioned when the fire is at some distance away and water has to be sent through by force. In a town of small extent a hand escape and hose-cart will be all that is required, but in a larger town which has a sufficient water pressure for hydrant work a horse escape and hose-cart is generally used, to be followed by hand escapes and hose-carts. For this purpose a horse is kept on the premises, and is supplied by a job-master under special agreement.

The duty-room, when men are barracked on the premises, is furnished with ordinary tables and chairs, with ample cupboard storage-room for stationery, books, etc. Convenient space should be provided for the fixing of a clock, as time forms an important item for the filling in of reports. The greater portion of the wall space is occupied by the various telephone speaking apparatus, call bells, boards regulating the electric lights on the various floors, and speaking tubes connected with the firemen's rooms. The space required depends on local requirements, but plenty of room must be allowed for the addition of telephone apparatus from various private firms who may desire to be in direct communication with the station. At the Exeter Fire Station, which was visited for the purpose of this work through the courtesy of the chief Officer, Mr. Wm. Pett, practically the entire wall of an ordinary sized room is covered with telephone apparatus. This will serve to show that these form a fairly big item in the space which has to be provided. In the case where all messages are received at the police station, these arrangements will naturally be dispensed with, but it is fairly safe to say that direct communication with the fire station is much to be desired, and is practically universally adopted. Cases have been chronicled where loss of life has probably occurred through the delay occasioned by using the police station as an intermediary, or else when a messenger has made the fatal error of going to the fire station direct—a proceeding of which the average human being would be guilty—only to find that he had to report to the police station first of all.

The principle of the opening of the station and stable doors is illustrated in Fig. 161, which represents one as made by Messrs. Merryweather & Sons. The door is worked by a system of ropes and sheaths, the ropes joining together in a pull which hangs down conveniently close to the driver's seat. When ready he pulls the cords, which raise a lever acting on the bolt, which in its turn releases the doors; these are then swung open by means of the powerful spring fixed to the frame and the first panel of the door. The door folds back one panel against the other, guided by means of overhead and floor tracks, and so remains till closed again by hand, when the bolt is refixed and the ropes again pulled into position. The stable doors are worked on the same principle, with the exception that they open in two and are not made folding. When the station doors are to be made solid and not folding a slight variation is made, in that the cord would release a bolt fixed at the top of the overlapping door, and the doors would then swing back by means of a balance weight carried over a sheath to the wall, or by means of a specially twisted steel rod which is adjusted to give the necessary spring action; or, better than either of these, the same kind of spring as is shown in Fig. 161 can easily be used. Some sort of door-opening arrangement is desirable, but where the door is opened in the ordinary way a floor catch is essential, so that the door will remain in position and not sway to and fro, as is sometimes the case, so causing much inconvenience which can be easily avoided.

As to the horses' stable itself, we are now undergoing a period of transition during which the horse-drawn engine is gradually but surely giving way to the motor-driven steamer; and we find that such modern stations as Harringay and Wapping have dispensed entirely with horses. This gives economy of space in the station, as the length of an engine with the pole ready fixed exceeds that required by a motor engine; and again, there is the economy of horse-stabling, of the upkeep of the horse itself, besides the fact that a

motor engine attains a much higher speed of travel, and is generally acknowledged to be more reliable, as horses have often got completely out of hand and caused inconvenient delay if not serious accidents. However this may be, it is a matter of doubt whether the necessarily increased initial cost will make it worth the while of a small station, with a limited number of calls, to substitute the horse by the motor, while stations which already possess the horse-

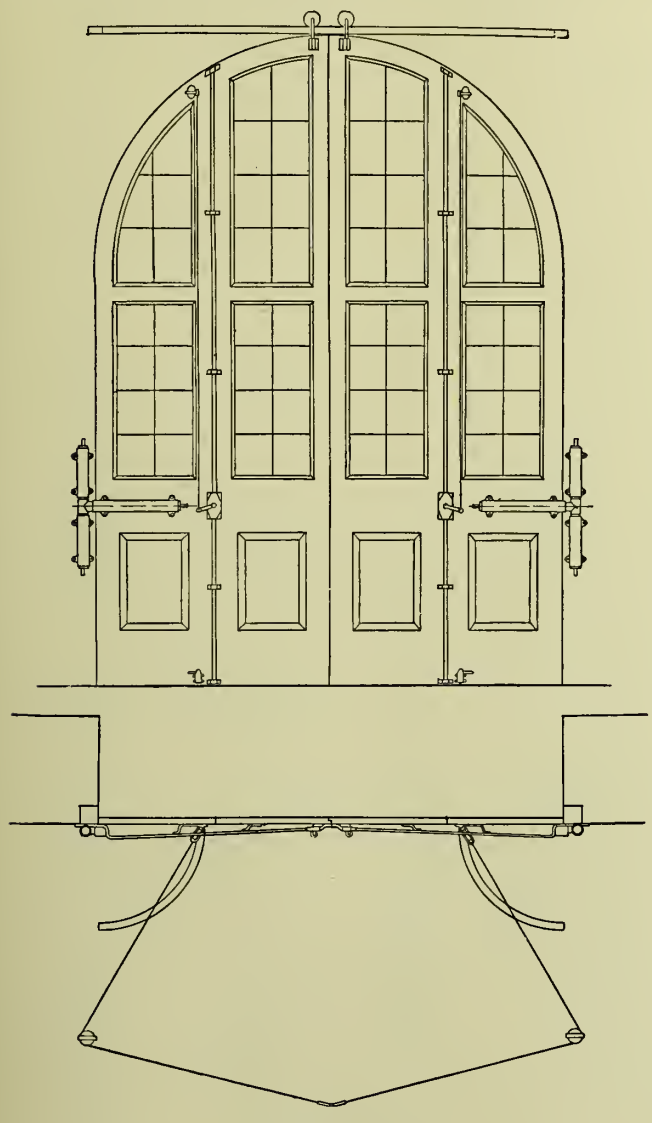


Fig. 161.

drawn engine will certainly continue to use it till such time as it should become worn out and past its work.

In a well-planned station for horse-drawn engines, such as that at Aldershot (Plate VI.), the head of the stalls will be made to face the engine, so that when the doors open automatically by rope control as above described, or by electric current, the horse, occupying the stall, is specially trained to go forward, releasing himself from the chain made for the purpose, such as that known as the Eggar chain, and leaving behind the covering rug, which is attached to each side of the stall and fastened by a slip buckle across the horse's chest.

There are several different arrangements of electrical automatic appliances for the opening of stable doors. Fig. 162 represents a system invented by Superintendent Bentley. All depends on electromagnets which release the bolts, and the doors, thus freed, open with the aid of special springs attached.

The electric conducting wires are placed as at A, and current releases the bolt at C by means of magnet B, and the doors revolve on spring at bottom of door as at E. The station outer doors fly open at the same time and in the same manner. To prevent the rebound of the doors a patent spring latch is fitted as at F. A push-button D operates the working of the harness, which is suspended by means of a counter-weighted chain running over a pulley. The harness is kept

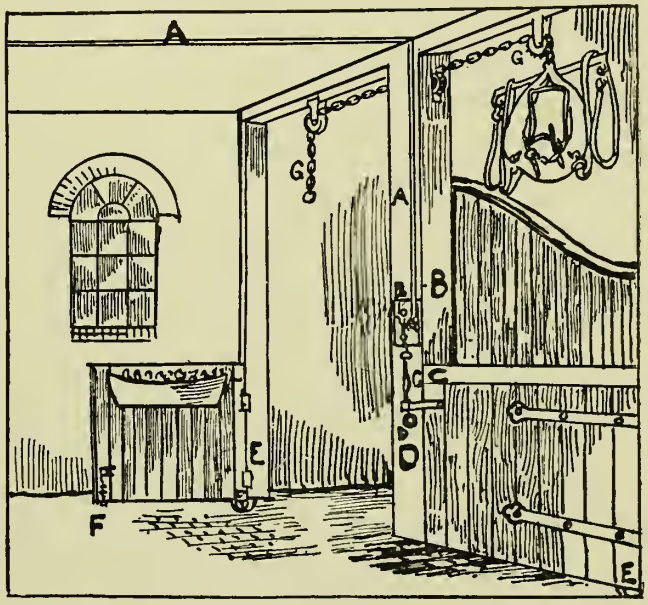


Fig. 162.

suspended by means of a small chain and pin, controlled by a lever which releases the pin on the current being applied. The weight of balance being slightly less than harness, the latter descends to the required level, and is placed on the horse's head and removed from the hanging chain, which is kept from running back by means of a special spring which keeps the counter-weight in position.

The attachment by which the horse is fastened to the stall is naturally not so secure as that which is found in an ordinary stable, and in order to prevent a horse from roaming about the stable should he become free from the fastening, a brass rod is fixed at the rear end of stall, hinged at one end and kept open by means of special indiarubber lined brass clips fixed to the heel post. The fixing of the manger presents some difficulty. It may be fixed to the door, as in Fig. 162, or where chopped food is used a small corner manger is fixed, which need not be of a great size, as in many

cases the horse is fed frequently and with a fixed quantity.

In some cases it would be impossible to arrange the stables in the manner described above. The stall would then be arranged in the ordinary way, with one full-length manger, or manger and hayrack, according to whether chopped food was used or not. The horse would be fastened by chain and slip-buckle in the ordinary ring, and here again it would be advisable to have the brass rail at rear, which, if in a station where doors, etc., are opened by electricity, could be made to rise, and the horse trained to turn round and make its way to the engine. An ordinary wooden or galvanised iron chest would be placed in the stable for the storing of food, with a small cupboard in which to place brushes and other requisites for grooming purposes.

The harness requires little or no accommodation, as the horse is kept ready bridled, whilst the collar and traces are suspended, by means of rope pulleys and balance weight, over the engine pole. The collars have one side attached to the pole, whilst the traces are connected to the sway bars and collars; and when the horses are in position the collar is pulled down and

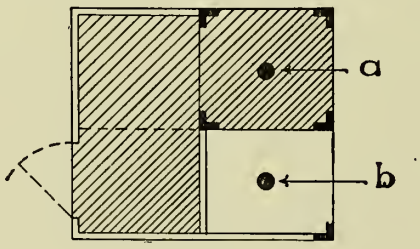


Fig. 163.

fastened by means of a spring lock, and the reins quickly attached by means of a clip-hook. In many stations a spare set of harness is kept in case anything should go amiss with the patent collars, and a spare set of brackets would be essential where provision is necessary for the housing of some extra horses.

Where firemen live on the premises their progress is expedited by means of poles from floor to floor, placed in the centre of an open well about 3 feet square. Fig. 163 gives a diagrammatic plan at one floor, the hatched portion showing the floor level to which access is obtained by the door shown in dotted lines, and which communicates with the apartments on that particular floor. The pole *a* is fixed between this floor and the one above, and the man having slid down this pole springs on to pole *b*, which carries him one floor lower, and so on till he finally reaches the ground level. For safety's sake the poles should only be between two floors, as otherwise one man might be getting on the pole just as the man above was sliding past, which would have a very awkward result.

The enclosure to the wells may be part of the building, or, if outside, may be constructed of angle iron with galvanised corrugated iron sheeting. Care should be taken to have a safe fastening to the door, preferably out of a child's reach, as otherwise this well would become a great source of danger to the younger popu-

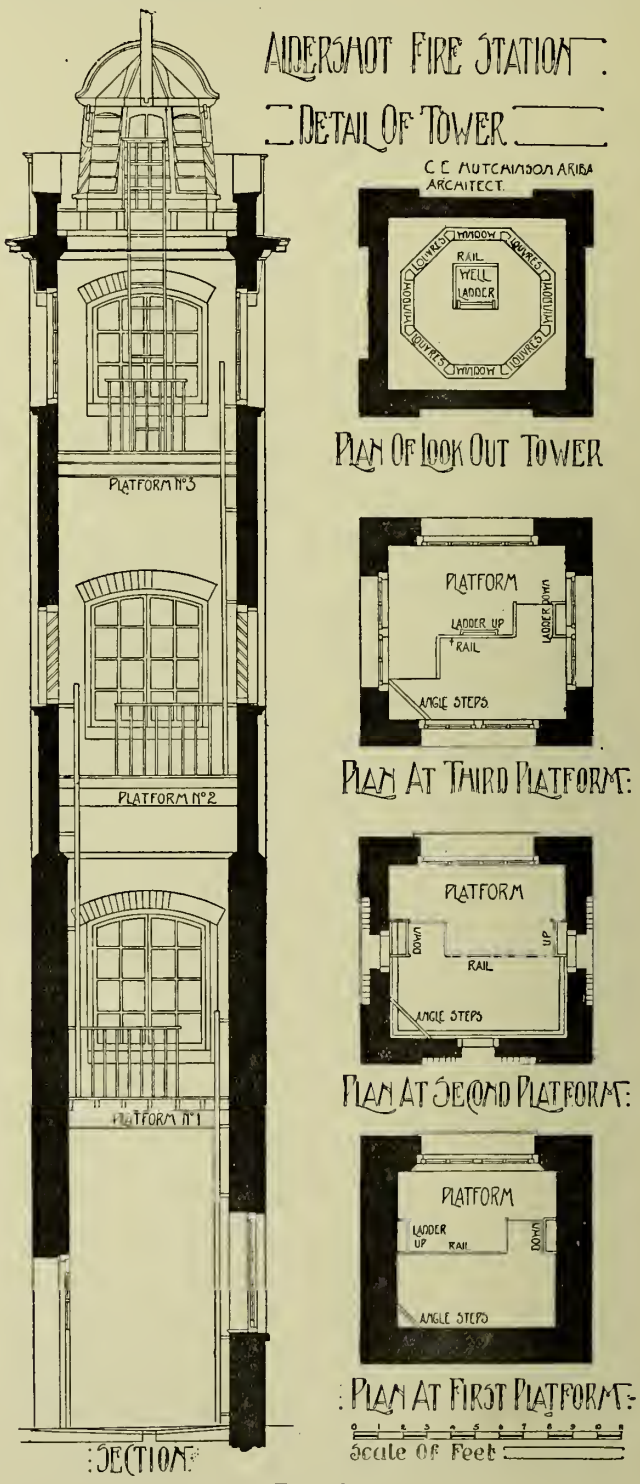


Fig. 164.

lation. The poles are made of steel or brass, the latter being preferred as wearing better and becoming less greasy than the former.

In the engine-room itself very few fittings are

necessary,—a fair amount of shelving to carry firemen's lamps, etc.; and ordinary japanned iron hooks on which to suspend scaling ladders extra to those carried on the horse escape. Where the firemen's uniforms are kept in the station, hooks are required, one in number being usually given to each man for helmets, uniform, and belt, and a pair of small hooks for the top-boots. Some officers are of opinion that it would be preferable to have an extra hook for belt and axe, but this is not customary.

Where a steamer is kept a canopy should be fixed in a suitable position to receive the steam and to carry it off by means of a flue or shaft, the necessary exhaust draught being obtained by a fan.

In fire station life the hose plays a very important part. In London stations a spare set is always kept. The number of lengths varies according to size of stations, but in one which was visited the steamer carried five lengths, the hose-cart three and horse fire escape five lengths, thus making thirteen extra lengths of hose to provide for. This is well and good where extra lengths can easily be obtained from neighbouring districts, but in provincial centres where this would be more difficult a much greater amount of spare hose is stocked, so that it is difficult to say definitely what provision should be made. It may be arranged to provide brackets for one spare set whilst the rest would be stocked on some strong and wide shelves.

When the hose has been used at a fire it is brought back to the station in a muddy and wet condition, and for its preservation it has to be well washed and dried. This may be accomplished on an ordinary concrete centre-drained floor, or in an underground tank, but preferably in a trough some eight inches below yard level, made to as great a length as is convenient and with a good slope. In this a supply cock is fixed with waste pipe and plug, or else a special hydrant is made for this, where a draw-off cock is supplied. A hydrant should be provided in some part of the station, as in the event of a fire, where no hydrant was close at hand, the chief officer might find himself in the unenviable position of being unable to put out a fire on his own premises. The hose may also be hung up at some height and a hose played on it. One thing which must be considered is, that it is important that the hose should be washed without delay, and the washing place should be, as much as possible, sheltered from the rain.

For drying hose the escape tower is used, if such forms part of the building. A special tower is often constructed for the purpose, either solidly built of brick or stone (see Fig. 164), or else more economically of iron cased in with galvanised corrugated iron sheets. In any case the building should be well sheltered and liberally ventilated. Hose is also sometimes placed for drying in an ordinary open ironwork tower, the top platform of which serves as a look-out, but this would naturally prove far from efficient in case of rainy weather. If the station is heated by means of hot-water pipes, these may with advantage be utilised to provide heat to the hose tower, and, where the plan will allow of it, a useful device is to connect the hose tower with the engine-house by means of a sliding shutter, so that the hose can be drawn into the station without going outside. Hot air cupboards are also a good means of drying hose, but these should be made as long as possible, so that the hose may not be much bent.

The hose lengths are raised by means of double-blocks and ropes, and are carried on carriers known as "toggles," which in the Metropolitan Fire Brigade are made to carry one length at a time, but may be obtained of sufficient size to carry six lengths. A cord is fastened to the grooves at each end of toggle, and is connected to the block.

CHAPTER XII

UNCLASSIFIED BUILDINGS

THERE are a good number of buildings the classification of which is impossible. In some cases they appear to belong to two or three classes, or to lie midway between them, while in others they are unusual erections only called for with extreme rarity. It will be found, however, that general principles which have been discussed in previous volumes apply in almost all cases, while variations and eccentricities of requirement give an architect his best opportunities for showing initiative and personal power of grappling with

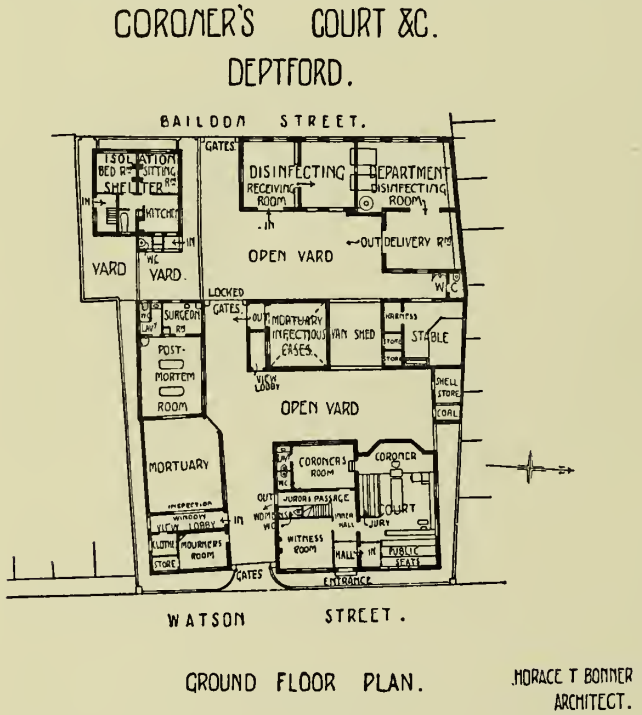


FIG. 165.

difficulties. In the present chapter it is intended to pick out a few of these miscellaneous threads, without endeavouring to be in the slightest degree exhaustive—which would, in fact, be an impossibility.

Such a building as the Coroner's Court at Deptford, designed by Mr. Horace T. Bonner, A.R.I.B.A. (see Fig. 165), almost belongs to the class of public buildings dealt with in Volume IV., yet it is a somewhat unusual building, containing not only the court but the ordinary disinfecting establishment found more frequently in connection with a hospital. The plan has been followed of arranging the court-house, with its caretaker's dwelling over it, as an isolated establishment from which the mortuary and post-mortem rooms, both for infectious and non-infectious cases, can only be approached by passing across an open yard. In each case the mortuary has an inspection window, in order that the jurors may view the bodies without actually entering the mortuary chamber, while an adjacent post-mortem room has been provided for the use of pathologists. These erections are served by a yard opening out into the main street. From this there is also communication to another yard reserved for the disinfection of clothing in all cases of infectious illness within the borough. This would be brought in closed vans down the back street, passed into the receiving room, through the disinfector, and thence to the delivery-room, where it would be sorted and then handed into different vans for conveyance back to the owners. A stable is provided in connection with this yard, with the necessary van sheds, in which presumably an ambulance would also be kept. A rather unusual addition to this group of buildings is an isolation shelter arranged in two floors, the lower for men and the upper for women, entirely separate and served by different entrances.

Buildings which are erected for the purpose of carrying on special industries are always of a highly specialistic character, and difficult to classify. Several have already been illustrated when dealing earlier in this volume with the equipment of certain well-known classes of buildings of this type. All, however, conform to this general rule, that the rooms or departments must be so arranged that the goods may be passed along in regular sequence through the various processes which they have to undergo, entering as raw material and passing out as finished products, with as little handling as possible and no confusion. If there be only one door the work has, as it were, to circle, so as to return to the point of entry or completion, but it is always better to have a separate entrance and exit, as is admirably exemplified in the laundry at Southport, illustrated in Plate V. In many instances vertical planning is of as great importance as is the horizontal, the goods being conveyed by lifts from floor to floor, and in such cases it is perhaps more common than not for the raw material

to be taken to the top, and for the work to be done so that the goods pass gradually downwards to the delivery yard on the ground floor.

In this connection it is thought well to introduce a plan here of the out-dyeing department of the

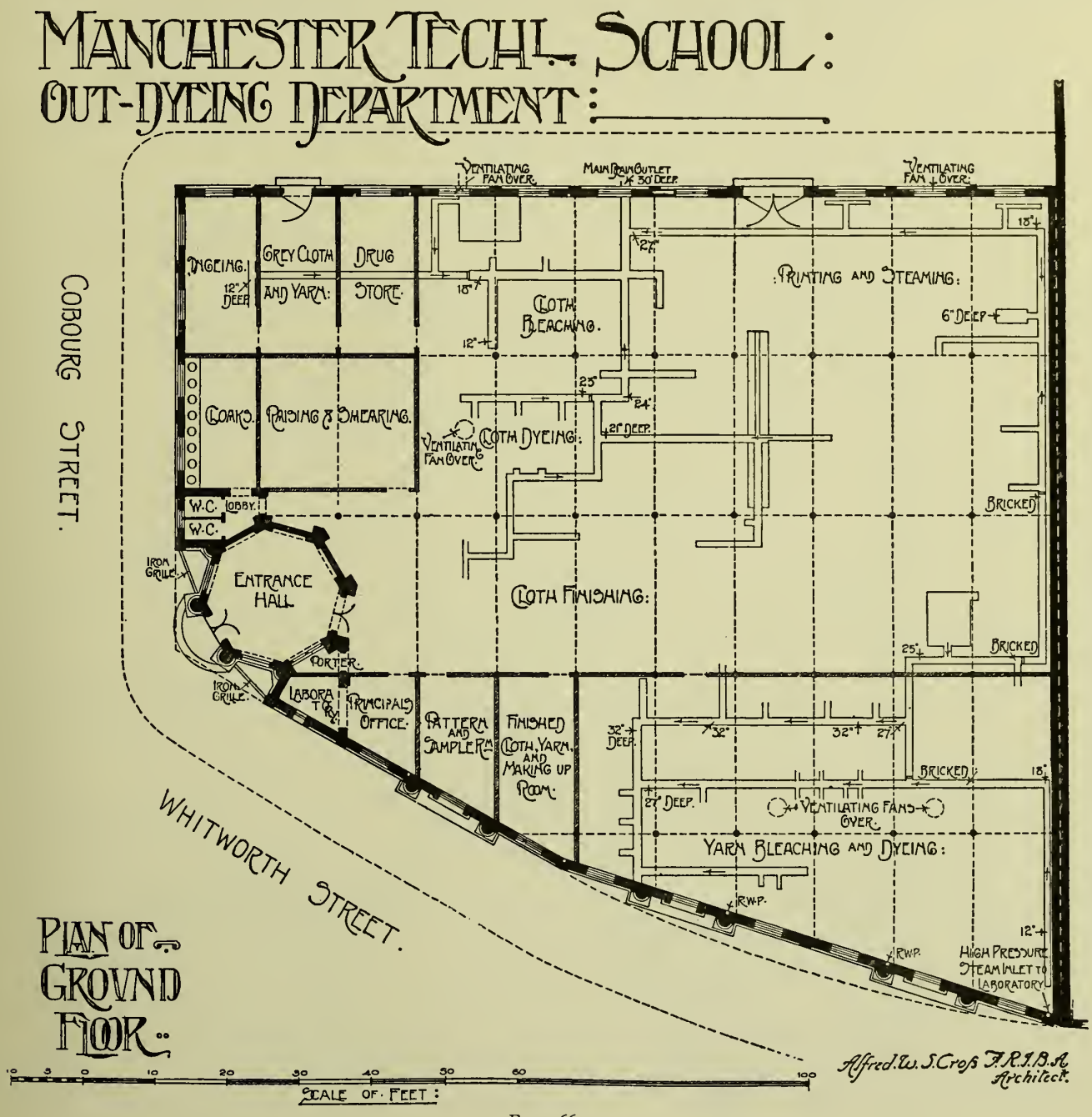


FIG. 166.

Manchester Technical School (Fig. 166), rather than under the heading of schools. Being a school, it naturally differs somewhat from an actual practical dyeing establishment, but not to any very large extent, the principal's office taking the place of the manager's and clerk's offices of an actual workshop. There is a separate enclosed space for yarn bleaching and dyeing, as distinct from the main body of the floor where clothing is dealt with, in each case portions of the floor being separated off from other portions for particular processes, and all served by carefully devised open channels through which the spare water flows away, there being naturally a large amount of water used in the work; and two tanks will be noticed in connection with these channels. There are also separately partitioned rooms for certain special purposes, the partitions not necessarily being carried up to the ceiling. The storage-room for finished material and the pattern sample-room are placed close to the

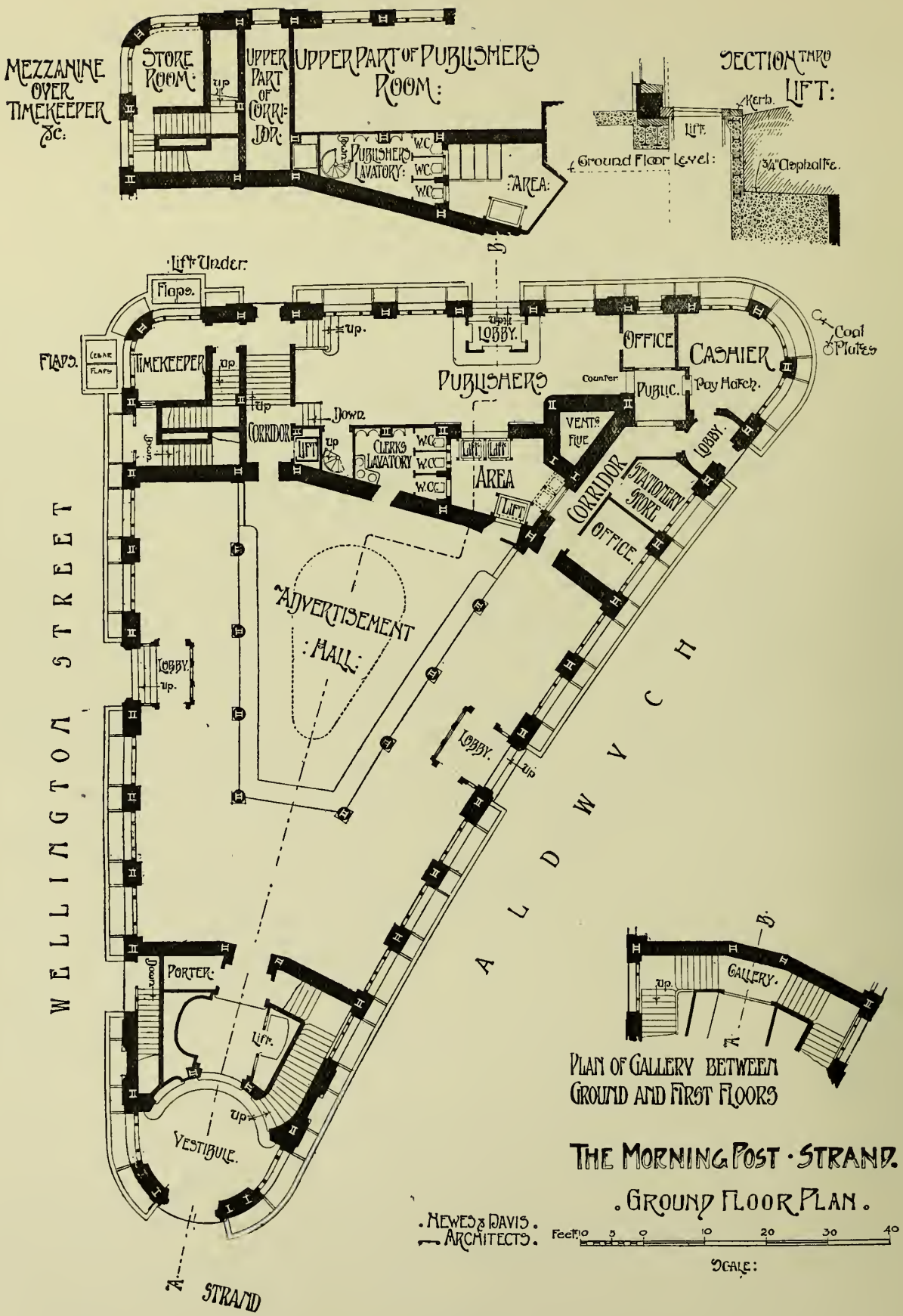

MEZZANINE OVER TIMEKEEPER &c.
STORE ROOM:
UPPER PART OF CORRIDOR:
UPPER PART OF PUBLISHERS ROOM:
PUBLISHERS LAVATORY:
W.C.
AREA:
SECTION THRO LIFT:
Kerb.
Lift
Ground Floor Level:
3/4" Asphalte.
B.
Lift Under
Flaps.
LOBBY.
OFFICE
CASHIER
Coal Plates
FLAPS.
TIMEKEEPER
Counter
PUBLIC.
Pay Hatch.
PUBLISHERS
CORRIDOR
Down
VENTS FLUE
CLERKS LAVATORY
LIFT
AREA
LOBBY.
STATIONERY STORE
OFFICE.
ADVERTISEMENT HALL:
WELLINGTON STREET
ALDWYCH
PORTER.
VESTIBULE.
A
STRAND
GALLERY.
PLAN OF GALLERY BETWEEN GROUND AND FIRST FLOORS
THE MORNING POST · STRAND.
. GROUND FLOOR PLAN .
. MEWES & DAVIS . ARCHITECTS .
Feet 0 5 0 10 20 30 40
SCALE:

FIG. 167.

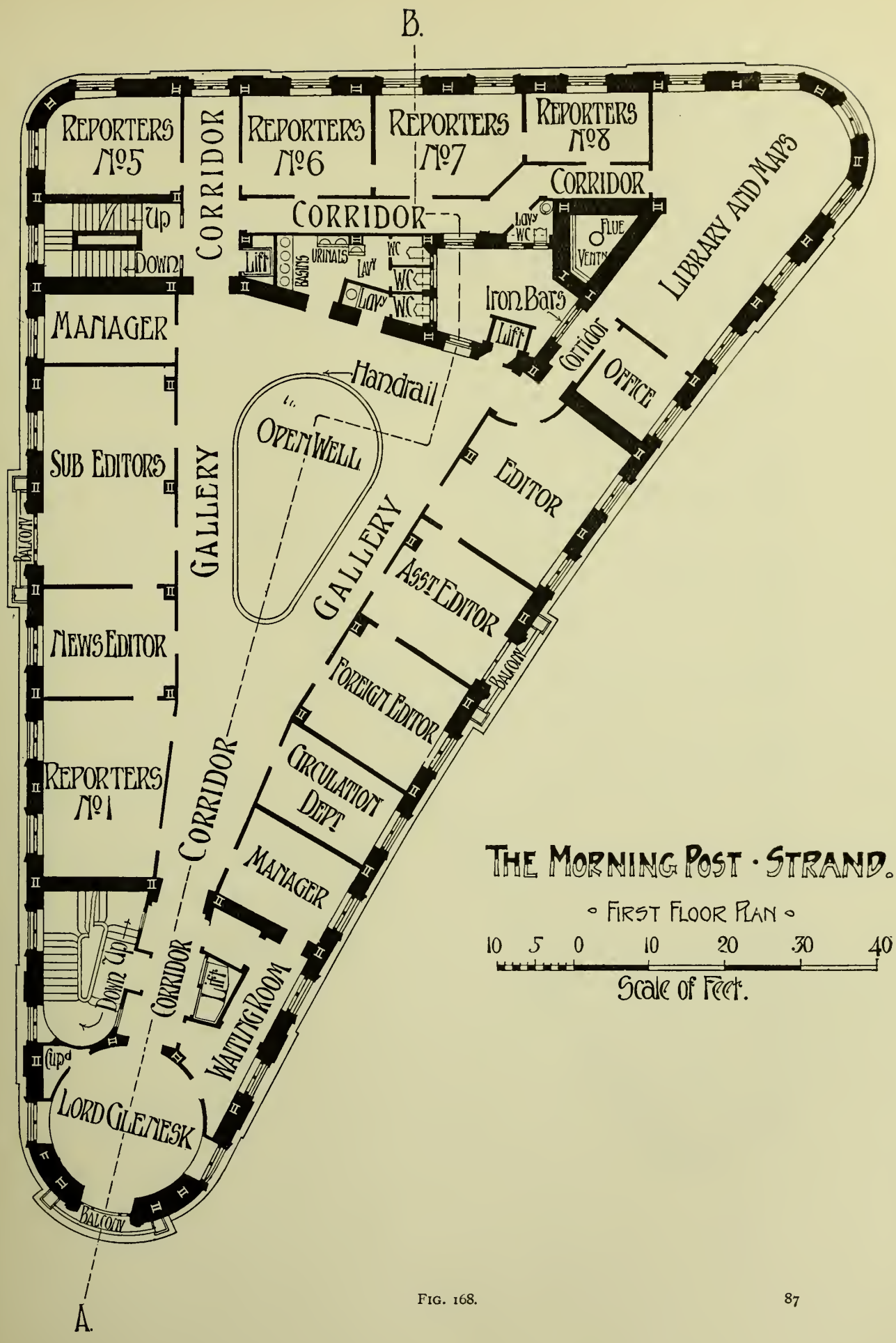

B.
REPORTERS No5
CORRIDOR
REPORTERS No6
REPORTERS No7
REPORTERS No8
CORRIDOR
CORRIDOR
LIBRARY AND MAPS
Up
Down
Lift
BASINS
URINALS
LAV
W.C
W.C
W.C
Lavs
Lavs W.C
FLUE VENTS
Iron Bars
Lift
Corridor
OFFICE
MANAGER
Handrail
OPEN WELL
EDITOR
SUB EDITORS
GALLERY
GALLERY
ASST EDITOR
BALCONY
NEWS EDITOR
FOREIGN EDITOR
BALCONY
REPORTERS No1
CIRCULATION DEPT
CORRIDOR
MANAGER
Down Up
CORRIDOR
Lift
WAITING ROOM
Clip
LORD GLENESK
BALCONY
A.
THE MORNING POST · STRAND.
FIRST FLOOR PLAN
10 5 0 10 20 30 40
Scale of Feet.

FIG. 168.

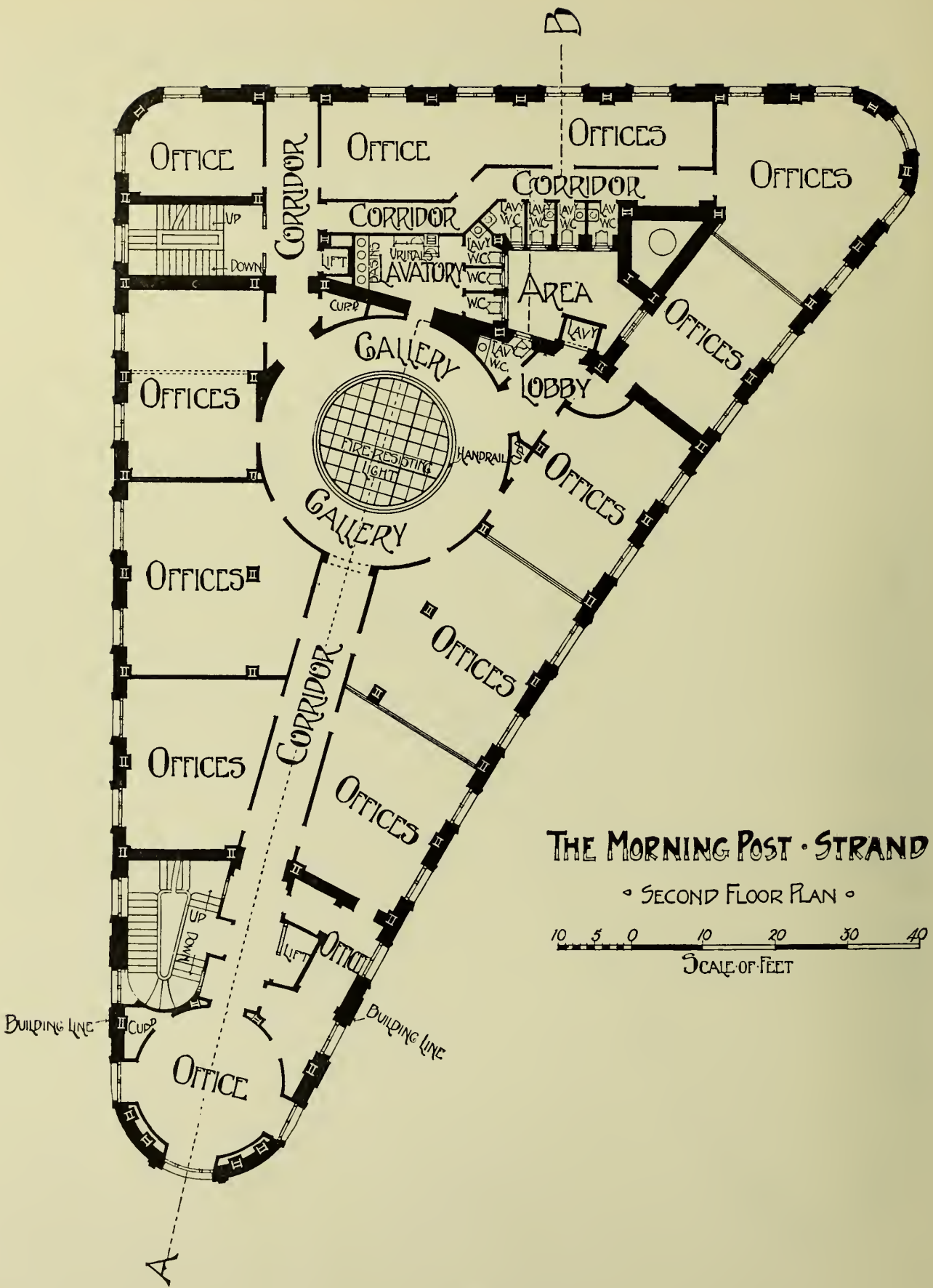

OFFICE
OFFICE
OFFICES
OFFICES
CORRIDOR
CORRIDOR
CORRIDOR
UP
DOWN
LIFT
CASH
URINALS
LAVATORY
LAVY
W.C.
AREA
CUPB
GALLERY
LOBBY
OFFICES
FIRE-RESISTING LIGHT
HANDRAIL
OFFICES
GALLERY
OFFICES
OFFICES
OFFICES
CORRIDOR
OFFICES
OFFICES
UP
DOWN
LIFT
OFFICE
BUILDING LINE
CUPB
BUILDING LINE
OFFICE
A
THE MORNING POST · STRAND
SECOND FLOOR PLAN
10 5 0 10 20 30 40
SCALE OF FEET

FIG. 169

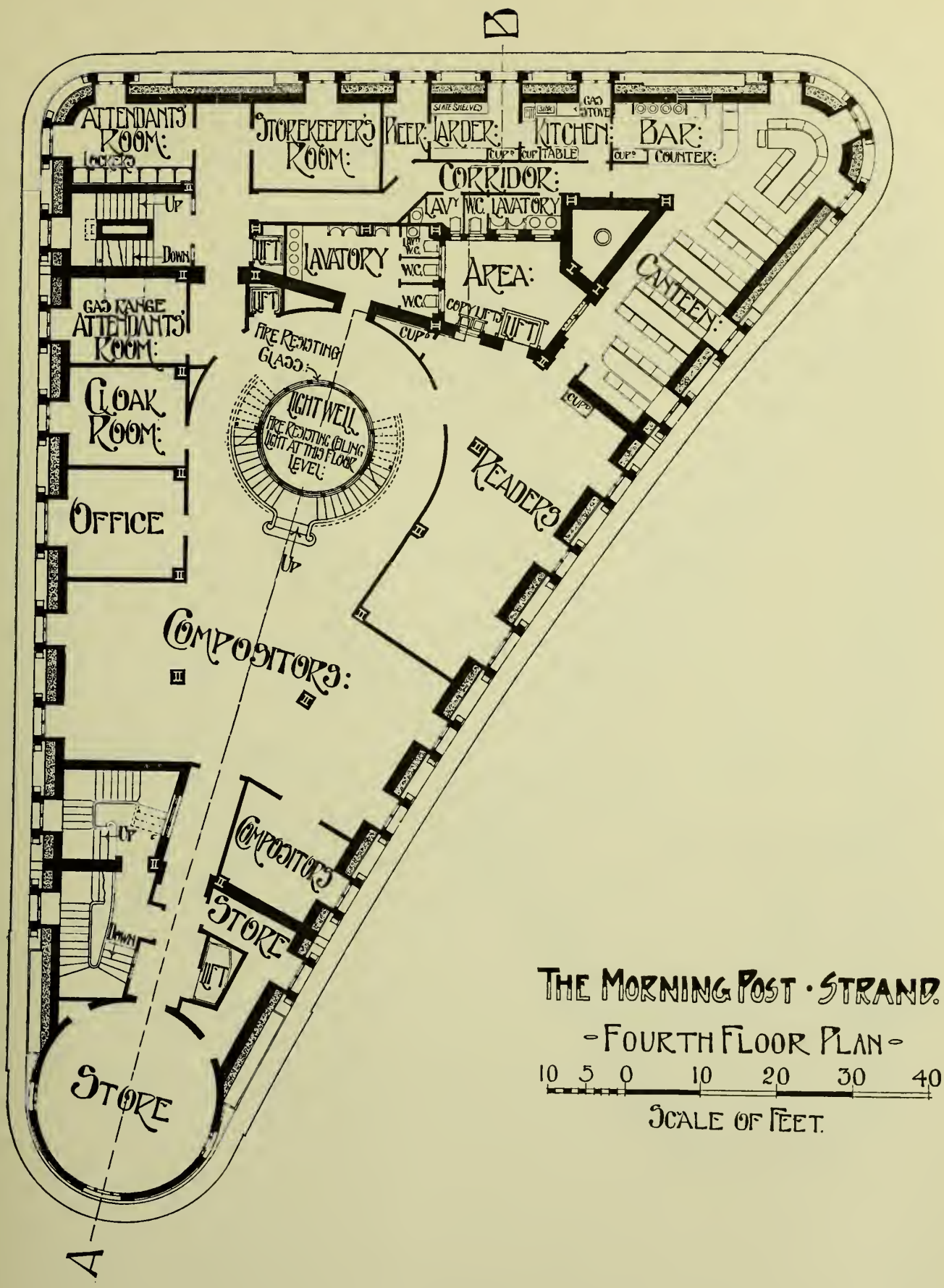

B
ATTENDANTS ROOM:
LOCKERS
STOREKEEPER'S ROOM:
PEER:
SLATE SHELVES
LARDER:
SINK
GAS STOVE
KITCHEN:
CUP°
CUP°
TABLE
BAR:
CUP°
COUNTER:
CORRIDOR:
LAV^Y
W.C.
LAVATORY
Up
Down
LIFT
LAVATORY
LAV^Y
W.C.
W.C.
W.C.
AREA:
CANTEEN:
GAS RANGE
ATTENDANTS ROOM:
COPY LIFT
LIFT
CUP°
FIRE RESISTING GLASS
CUP°
CLOAK ROOM:
LIGHT WELL
FIRE RESISTING CEILING LIGHT AT THIS FLOOR LEVEL
READERS
OFFICE
Up
COMPOSITORS:
COMPOSITORS
Up
STORE
LIFT
Down
STORE
A
THE MORNING POST · STRAND.
- FOURTH FLOOR PLAN -
10 5 0 10 20 30 40
SCALE OF FEET.

FIG. 170.

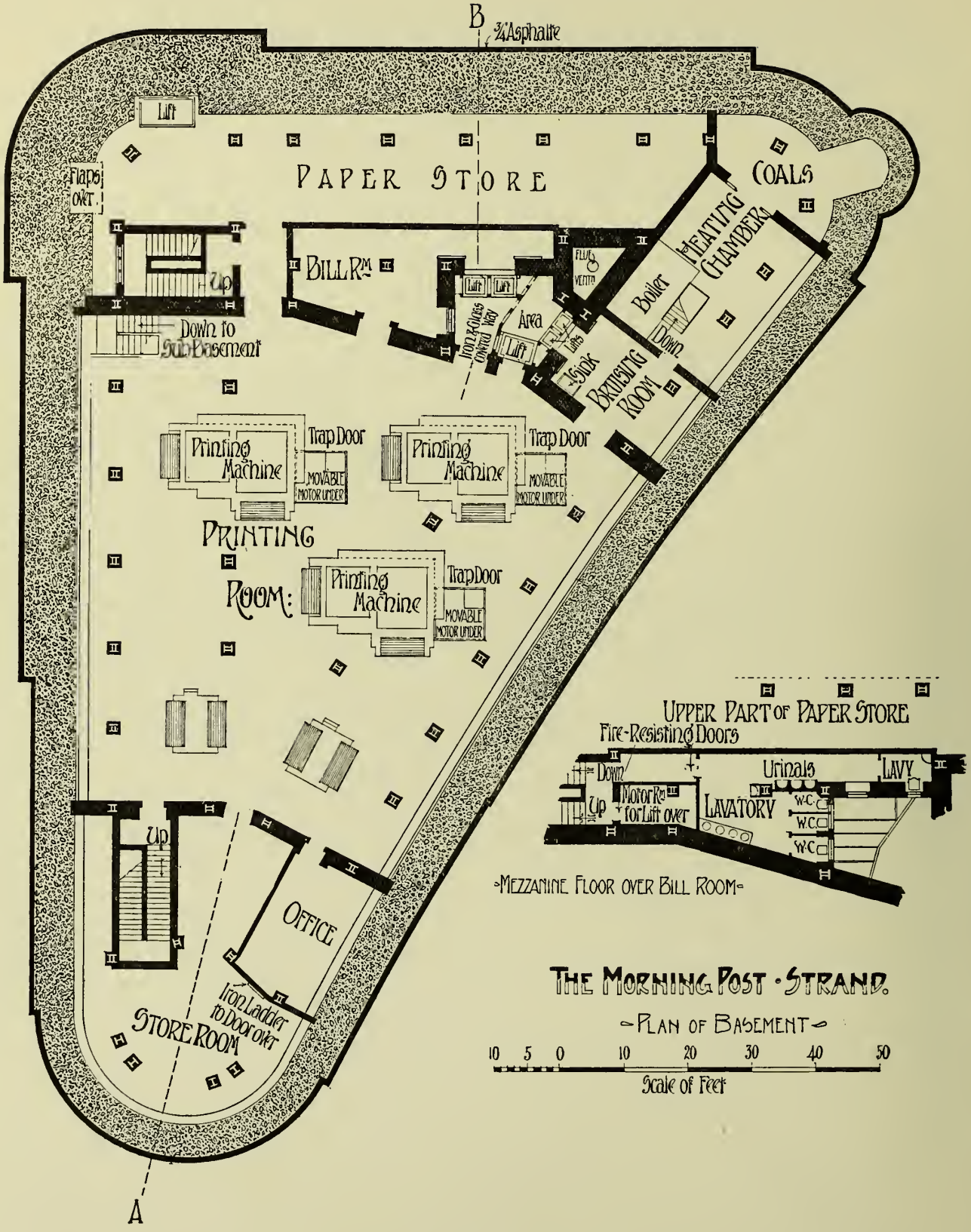

B
¾ Asphalte
Lift
PAPER STORE
Flaps over
COALS
HEATING CHAMBER
Up
Down to Sub-Basement
BILL Rm
Lift
Lift
FLUE & VENTS
Boiler
Down
Iron & Glass Covered Way
Area
Lift
Lifts
Stock
BRAISING ROOM
Printing Machine
Trap Door
MOVABLE MOTOR UNDER
Printing Machine
Trap Door
MOVABLE MOTOR UNDER
PRINTING ROOM:
Printing Machine
Trap Door
MOVABLE MOTOR UNDER
Up
OFFICE
Iron Ladder to Door over
STORE ROOM
A
UPPER PART OF PAPER STORE
Fire-Resisting Doors
Down
Up
Motor Rm for Lift over
Urinals
LAVY
LAVATORY
W.C.
W.C.
W.C.
MEZZANINE FLOOR OVER BILL ROOM
THE MORNING POST · STRAND.
PLAN OF BASEMENT
10 5 0 10 20 30 40 50
Scale of Feet

FIG. 171.

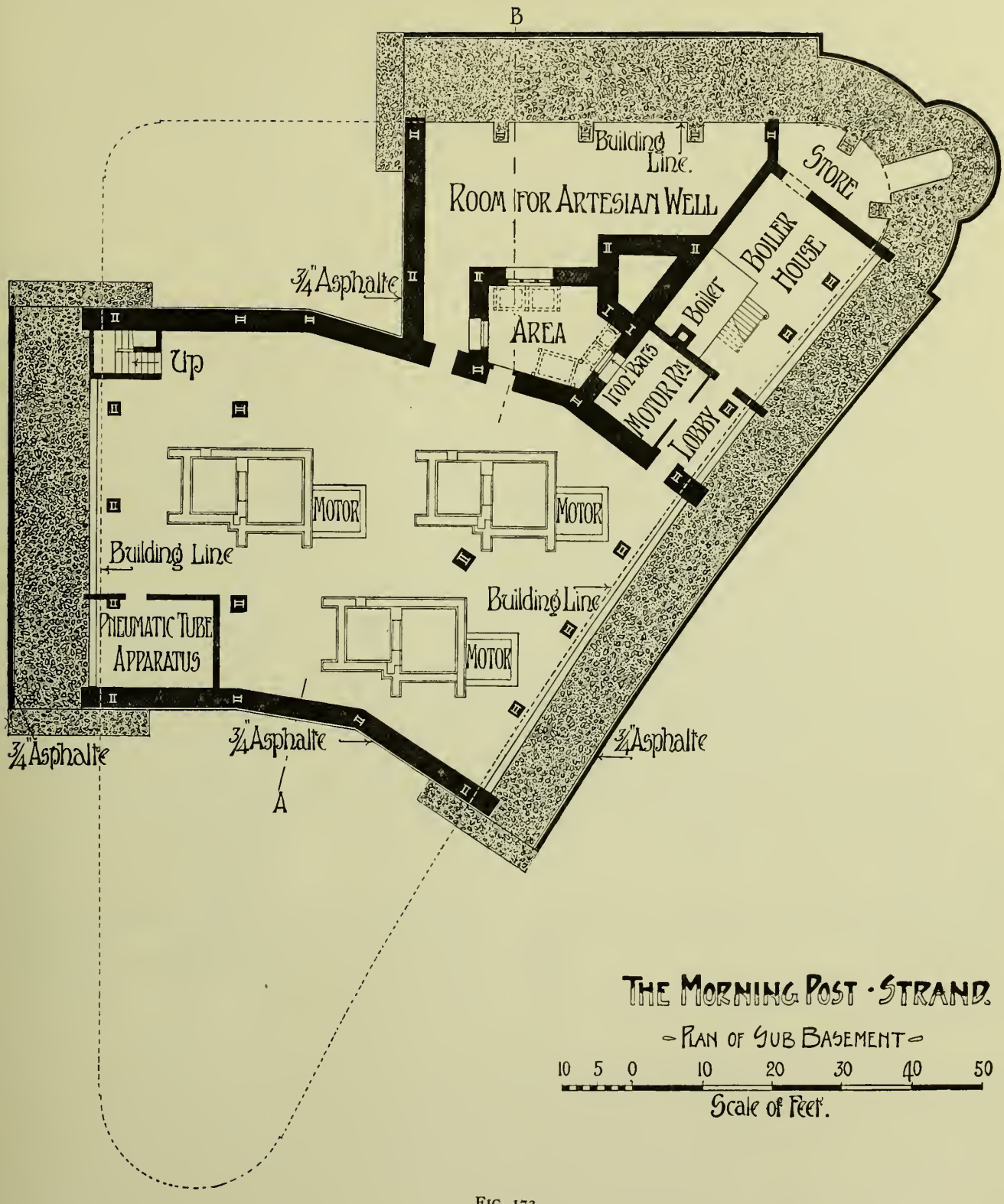

B
Building Line.
Room for Artesian Well
Stoke
Boiler House
Boiler
Area
Iron Bars
Motor Rm
Lobby
¾" Asphalte
Up
Motor
Motor
Building Line
Building Line
Pneumatic Tube Apparatus
Motor
¾" Asphalte
¾" Asphalte
¾" Asphalte
A
The Morning Post · Strand.
Plan of Sub Basement
10 5 0 10 20 30 40 50
Scale of Feet.

Fig. 172.

principal's office just as they would be in practice, but the entrance hall, it may be said without offence to the architect, Mr. A. W. S. Cross, is an unnecessarily handsome apartment for a workshop, though perfectly justifiable in a school. The elevation has appeared already as one of the illustrations to Volume V.

The same idea of sequence of process is that which has to control an exceptional building such as a large newspaper office, like that now being erected in the Strand for the *Morning Post* from the designs of Messrs. Mewes & Davis. In an establishment of this sort there are very many conflicting demands upon the architect's skill. There is necessarily on the ground floor a large public office for receiving advertisements, as an entirely distinct establishment from the publishing office, which must also be located there, while the editorial department again has to be accessible to the public from the main entrance. Thus the receipt of matter in the form of advertisements must take place on the ground floor, while the receipt of editorial matter, much of which comes by telephone and telegraph, can be arranged for on another floor, preferably the first floor, while the issue of the papers also takes place on the ground floor. Circulation therefore must be from ground floor to ground floor, and must obviously to a considerable extent be carried on by lifts. On account of the great weight of the printing machines it is preferable that these should be stationed in the basement, to which it is quite easy to convey the necessary paper from the street level, and the finished results can then be lifted in the publishing office for distribution. On the other hand, for sake of light, the compositors ought to be at the top of the building; for whether composing machines be used or the composing done, as it occasionally must be, by the old fashioned composing-stick, the more light that can

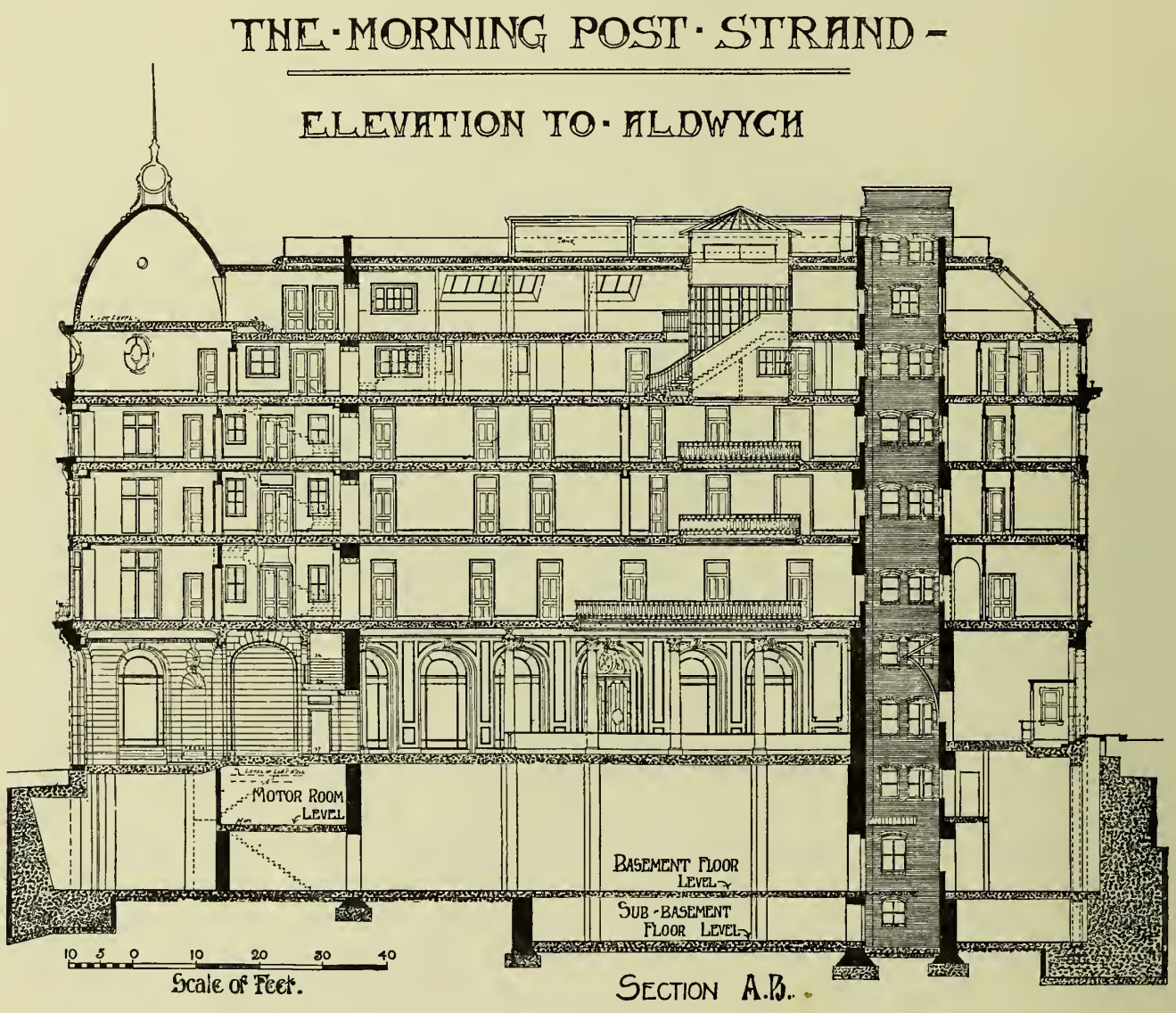


Fig. 173.

be obtained for the work the better. As a matter of convenience the foundry-rooms, for making the matrices and castings from the type for placing upon the actual printing presses, should be close to the composing-rooms, and these also are frequently, as in this case, placed on the top floor. The sequence is consequently from the ground floor (Fig. 167), which contains the advertisement hall and the publishing office, and the first floor (Fig. 168), which is given up to the editorial staff and reporters, to the second and third floors (Fig. 169), which are devoted to offices for artesian well. The general vertical arrangement is shown in the section (Fig. 173). In order to prevent the spread of fire, and to comply with the requirements of the London County Council, it was necessary that the goods lifts should be carried up in an area external to the building, and this has to a considerable extent influenced the plan. There is one great lift passing from basement to top for carrying the heavy matter, while two other lifts of considerable size pass from basement (Fig. 171) to the ground floor (Fig. 167) only, for the supply of the finished papers to the large

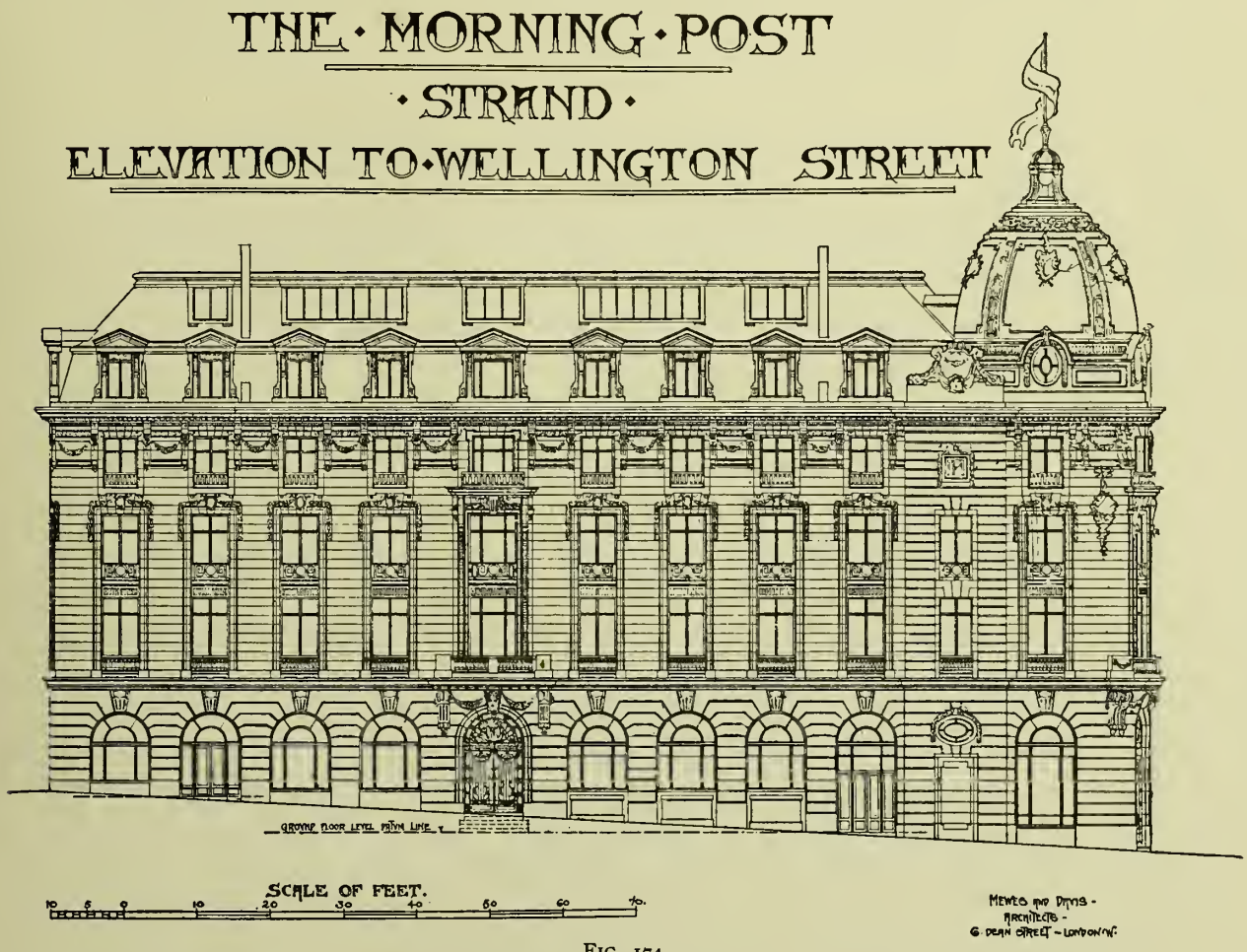


Fig. 174.

members of the staff who do not come into immediate contact with the public, upwards to the fourth and fifth floors (Fig. 170), where the work of composing and casting the type is done, and where also the readers have their rooms, and where a large canteen and bar are in this particular instance provided for the use of the staff. After the type has been approved and cast it is passed down in a large lift to the basement (Fig. 171), where the printing takes place, the finished papers being afterwards passed up again to the publishing office. There is also a sub-basement (Fig. 172) for the engines and motors which drive the presses, and containing also a boiler-house and a room for an publishing office. Other small lifts are introduced where occasion demands, in the same area, mainly for "copy," extending so many floors as is necessary. Passenger lifts, being permitted within the building, are introduced in the well of the main staircase at the axial entrance from the Strand, at the junction between Wellington Street and Aldwych, running from the ground floor to the third floor. There is also another, providing communication for the staff from the ground floor to the top of the building, close to the staff entrance from Exeter Street, and reached either by the staff of the publishing office or that of the advertisement hall; though probably the workmen

in the composing-rooms would not be allowed to use it, as they have a special staircase provided for them controlled from the timekeeper's office. The composing and clerical staff reach this staircase from Exeter Street. It passes up above that which goes down to the printing office from Wellington Street, round a well enclosed by solid 9-inch walls, in accordance with the usual regulations for warehouse premises.

ing a proper sequence of operations necessary in the conduct of a large newspaper. The many necessary small conveniences, such as the proper placing of cashier's office and of manager's rooms, have all received attention, while good lighting of all the offices is obtained by ranging them along the external walls, reached by galleries and corridors occupying the centre of the site, and top lighted down an open well from a

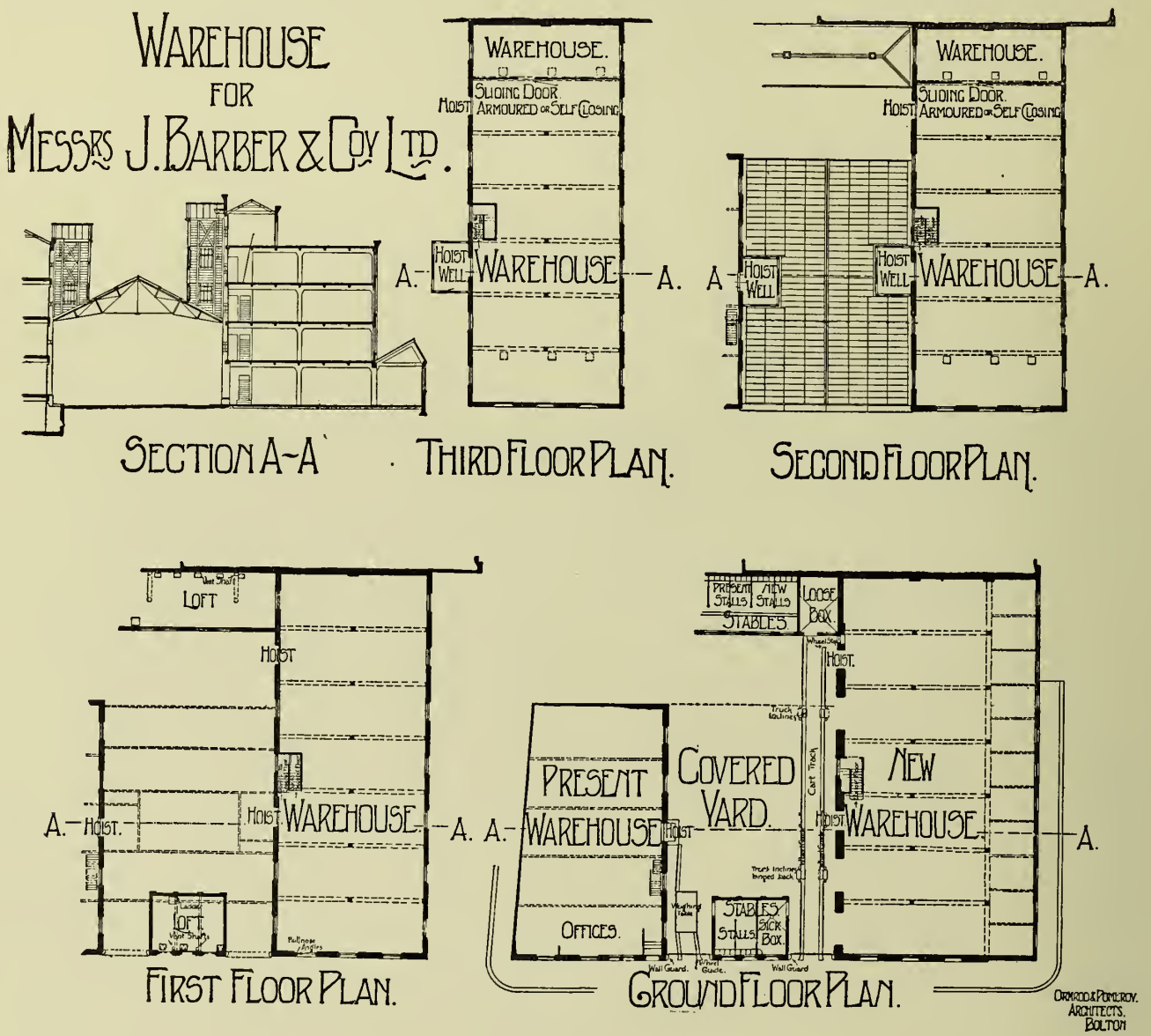


FIG. 175.

The strong wall which is shown separating the building on all the floors into two compartments is necessitated by the London Building Act.

The general principles of the plan, with its axial arrangement to each frontage for elevational purposes, hardly need special describing after what has already been said with regard to other buildings. Its main peculiarity lies in the vertical planning, to which attention has already been called, for the purpose of obtaining a large lantern in the roof. There are many places where mezzanines have been resorted to in order to economise space and meet the peculiar circumstances of a somewhat awkward site, as, for instance, where the main staircase is carried as a gallery across the entrance to the advertisment hall, and where the great height needed in the advertisment hall and publishing office is utilised to accommodate two storeys of smaller offices and lavatories. One of the elevations, which have

GROUND FLOOR PLAN.

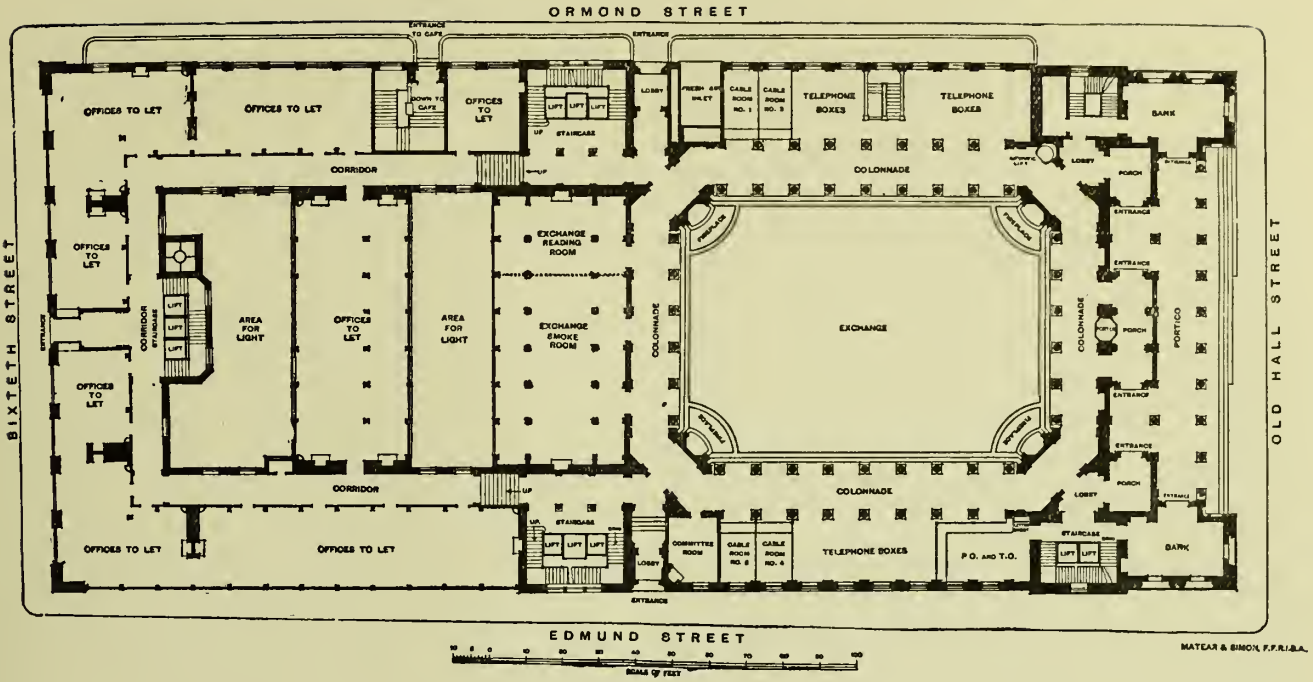


FIG. 176.

FIRST FLOOR PLAN.

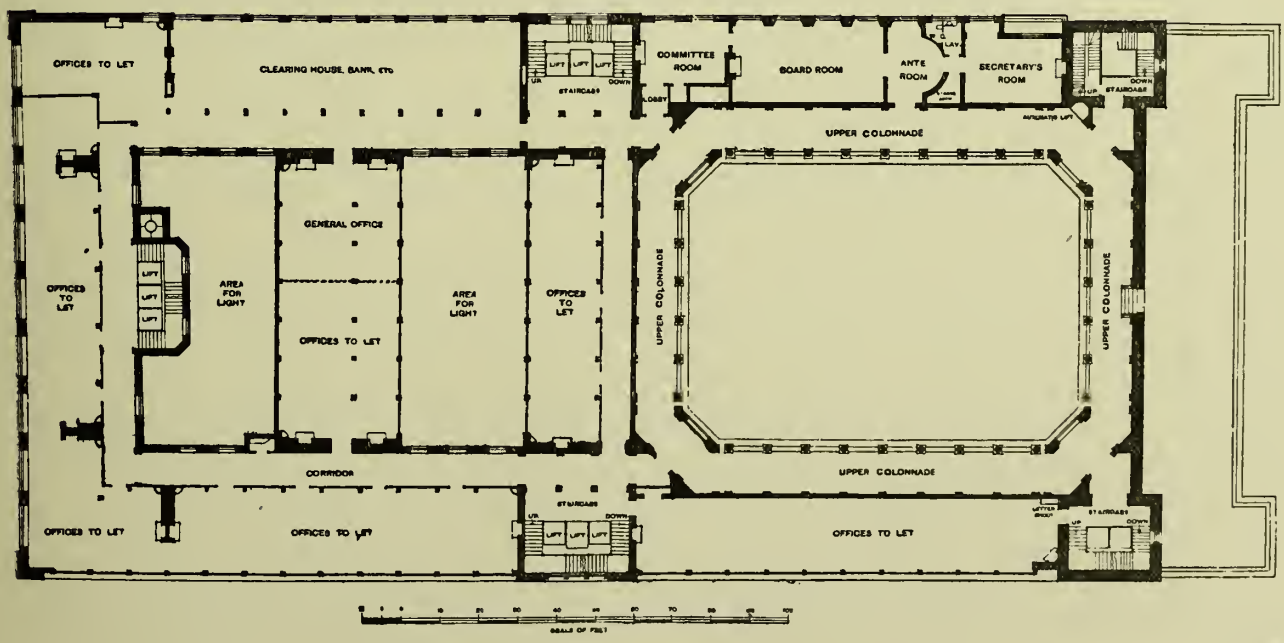


FIG. 177.

been designed in a modern French style, is shown in Fig. 174.

Warehouses, such as that planned by Messrs. Ormrod & Pomeroy (see Fig. 175), are such exceedingly simple buildings that little need be said of them, save that it is advantageous to design them, so far as may be, with perfectly clear spaces for the handling of goods, sometimes with a portion screened off at one end for either offices or the storage of some special material, but with the hoists if possible placed in external wells so as not to interfere with the warehouse floor. So far as the staircase is concerned, in this particular instance it was a matter of choosing whether to interfere with the floor space or with the cart-way on the ground floor, and necessarily the latter had to have the preference, as the carts had to be brought close up to the warehouse wall, that they might stand immediately under the hoist wells. A single large covered yard is placed between the existing warehouse and the new one, so as to serve both, and a weighing table is shown to which all carts can be brought if required. A certain amount of the yard space is taken up by stables, which also occupy its rear. In all buildings of the warehouse class it is necessary to build the stairs round a solid brick wall, and enclosed in brick walls, while they ought to be of fire-resisting construction, like the whole of the walls and floors throughout. It is very usual now to adopt armoured concrete for the purpose, though steel frame-work construction is also largely used. Both of these have been dealt with in some detail in Volumes IV. and V. of this work. If columns are introduced they should always be covered with concrete, in order to preserve the metal from the effects of fire, and to prevent it from being damaged by the impact of moving material; but they are better avoided as far as possible, as they interfere with the clearness of the open space which is so valuable for the storage and easy handling of bulky goods.

Another exceptional building to which attention may be called is the Cotton Exchange at Liverpool, designed by Messrs. Matear & Simon, FF.R.I.B.A., and illustrated in Fig. 176.[1] It has the advantage of occupying a rectangular isolated site, and has been planned as much for external effect as for convenience, the front to Old Hall Street in particular being arranged for architectural display, with a long, large portico across it, and bank premises at the two corners. A longitudinal axis has been adopted, along which occurs the great open space of the Exchange, with its fine colonnades round it, and various offices opening from the colonnade, and lighted from the streets on either side. Beyond this again are large reading and smoking-rooms, obtaining light from an internal area; while the whole of the back of the site is covered with a series of large offices served by an axial entrance and staircase from Bixteth Street. It will be noticed that a strong dividing wall separates the building into two portions—the Exchange proper, entered from Old Hall Street, and these offices in the rear. The offices are served by corridors which are in continuation with the colonnades of the Exchange, while axial entrances in Edmund Street and Ormond Street secure admission both to the Exchange and to the offices, and also by means of staircase and lifts to the upper floors, of which the first floor is illustrated in Fig. 177.

An upper colonnade passes right round the Exchange space, and gives access to committee-rooms and secretary's office on one side, and to a series of rooms which can be let off upon the other, while the back of the site is again occupied by offices to let. The notable feature is the axial arrangement and consequent perfect regularity of the scheme, with internal means of communication by means of the corridors and passages, lighted from large internal wells or courtyards, it being perhaps the most typical example of this type or method of planning which has been illustrated in any of these volumes,—a type which has survived from the far distant period of the earlier Egyptian temples.

[1] Figs. 176 and 177 are introduced by permission of the *Building News*.

CHAPTER XIII

THE DECORATION OF DOMESTIC BUILDINGS

(Contributed by Barry Parker and Raymond Unwin, MM.S.A.)

In a work which is intended to be a collection of practical treatises, a chapter on styles and periods in decoration, and interior fittings and fixtures, would be rather out of place. A disquisition upon the methods and materials used by painters and decorators, cabinet-makers, or any of the allied trades, is also outside the scope, if not of the book itself, at any rate of this chapter. It is more our purpose to summarise such conclusions as have been arrived at practically unanimously by all who have seriously studied these things, and to give a few guiding principles and a few facts, avoiding all controversial matters. Much that we shall say will therefore inevitably seem trite and stale.

It is better not to ornament at all, unless we can have really good ornament,—that is, ornament which is in the true meaning of the words, "A work of art"; and the only possible work of art is something which it has given pleasure to the worker to produce. This art-work may be reproduced by more or less mechanical processes, and still be something we are justified in using; but somehow, only that which has given joy in the making can in its turn give joy in the using, and, as a rule, the pleasure taken in producing a thing which passes through many mechanical processes before it reaches the user becomes so remote as to be almost negligible. This depends somewhat, of course, upon how mechanical the processes are. Some processes of reproduction involve so much art in their carrying out that they, as it were, keep the art in the thing alive. Many branches of printer's work, such as wood-block printing, say in wall-papers and fabrics, various lithographing and engraving processes, and so on, while they are means adopted whereby to multiply a thing indefinitely, require so much exercise of artistic feeling on the part of the craftsman, if they are to be successful, that the art is, to some extent, kept alive. Therefore this is a test we can safely apply to anything we propose to use in decorating our rooms. Has it given joy to the producer? And if the answer is no, we know that it is not a work of art. We shall come to feel that it has no beauty, and if we ever took any pleasure in it, that pleasure will not last. William Morris once said: "Have nothing in your rooms which you do not either know to be useful, or believe to be beautiful," and he would have always admitted that the first of these really includes the second, as the sphere of usefulness of the Beautiful is merely on a higher plane. Broadly speaking, the right method is to make the necessary and useful things in a room beautiful, and to be chary of introducing things we know to have no practical utility but which we believe to be beautiful. Even if we decide to admit things which we do not consider to have practical uses, but which we do believe to be beautiful, there are few of us who, on looking round our rooms, would not be surprised at the number of things we could find whose presence was justified neither by use nor beauty. All that enormous profusion of so-called ornament, mechanically produced and quite lifeless and useless, which is spread over everything, would have to go; and the relief we should feel to have substituted for it plain surfaces, and a little decorative painting, embroidery, carving, or metal work, done by the artist's own hand, would indeed be very great.

One reason why mechanically produced repeating ornament, such as we get in wall-papers, covering materials, many kinds of carpets and so on, can never be truly artistic is, that the ordinary use of these involves slicing through the ornament wherever the material is cut. In a floral wall-paper we get rows of mutilated forms along the lower edge of the cornice and the upper edge of the skirting, round every window and door, which the dulling of our artistic perceptions by use and custom alone makes us able to tolerate. The ornament in machine-made mouldings has to be cut through, no matter how bad the effect, at any point where it requires to mitre or terminate, and a border round a carpet often cuts the filling design in a barbarous way. This reference to carpets reminds us that anything that must be looked at from many different points of view should never be so designed as to look right only when seen from one point of view, therefore a vertical design is never right in a carpet, where it will as often be looked at upside down, or sideways, as the right way up.

Again, it should ever be borne in mind that almost all decoration, at any rate all decoration of walls, floors, and other large surfaces, is only rightly regarded when considered as merely a background for other things, and especially as a background for human beings; it should never be looked upon as complete in itself, but should always be thought of as

part of a whole, complete only when all is there that is eventually to come into the room it decorates.

Another golden rule to apply is Owen Jones' time-honoured maxim: "Ornament construction; do not construct ornament." This is a rule which it will not be found difficult to apply. It is pretty easy to see that we are constructing ornament when we have reached a point at which we begin to pile up, say, cabinet-maker's work which is not going to fulfil any such useful function as holding our books and papers, our cruet and salt cellars, or clothes and needlework, and so on, and cannot be said to be fulfilling the uses on a higher plane which belong to the work of art. If we make the lines of a chair such that we are unable to construct it in the simplest and most direct way that will ensure the most adequate fulfilment of its functions, we are constructing ornament. If we erect a pediment or piece of wall carried up above the eaves and roof of a building that we may form a niche in it in which to place a piece of sculpture, we construct ornament; if, however, we form a niche in which to place a piece of sculpture, in a wall which is really one of the walls of the building, we are ornamenting construction.

The one thing we never need fear in decorating our houses is that we shall get too monotonous an effect. We can quite safely, and generally with an effect of restfulness, spaciousness, quietness, and completeness, have our walls and woodwork of one colour throughout the house. An architect's client frequently says: "But if I have my walls, woodwork, and upholstery all this same colour I must surely have the tiles round the fireplace another colour, or I shall get too monotonous an effect." He does not realise that when one has done all one can to get a restful, quiet, and harmonious treatment, the inhabitants of the room and the things which will be brought into it sooner or later will unavoidably introduce a greater number of colours, forms, and textures than are artistically desirable. Getting an effect of too great monotony is the last thing one need fear, for it practically never happens.

We may be sure that our treatment of a domestic interior is not artistic in the true sense of the word if it does not produce a feeling of comfort; and to give this feeling of comfort we must have a look of cleanliness. This can only be obtained by using materials, surfaces, and colours which show the dirt. The words "cleanliness and comfort" seem inseparable; but no matter how clean a room really is, it is impossible to get this feeling of cleanliness and comfort if the things in it are, like those in the back sitting-room of an ordinary boarding-house, chosen because they will not show the dirt. When a woman in a clean white apron and a print dress opens the cottage door at which one has knocked, one has a pleasantly satisfactory feeling which the same woman in an equally clean brown cloth dress and a dull black apron could not give us.

A very short walk through our streets will suffice to reveal that one of the most common causes of architectural failures to-day is the want of appreciation on the part of our architects of the importance of gathering together the small enriched and detailed parts of the façades of our buildings, massing these in certain parts and enhancing them by their relation to and contrast with broad, plain surfaces, or the massive, solid, and constructional parts of the building. It would be easy to find hundreds of ways of illustrating this fact, either by its neglect in inferior work or its observation in good work; and a whole volume could, with advantage to the art of architecture, be devoted to its consideration. But one example must suffice for the moment. The great beauty of a rich late Norman doorway and the wall in which this occurs arises from the way in which all the moulding, enrichment, and ornament are clustered together round the door, allowing the plain wall surfaces to enhance them and to make them tell, and allowing them in their turn to enhance the beauties of the plain wall surfaces. Imagine for a moment the same amount of moulding, enrichment, and ornament used again, but impartially and evenly distributed over the whole surface of both wall and doorway recess! The suggestion sounds an absurd one, and yet a very little reflection will suffice to reveal that this is really what the modern architect does in his ordinary practice; and it was this which helped to produce many of the failures belonging to the decadent periods in architecture. Too often the available amount of moulding, ornament, and enrichment is impartially spread over the whole surface of the building, thickly or sparsely as funds allow, but with no appreciation of the gain to the building of collecting these together and clustering them on parts carefully chosen, thereby greatly enhancing their value and effect and that of the plain parts contrasted with them.

All this is equally applicable to the interior treatment of ordinary rooms. In a room where everything is equally ornamented, the beauties of none of it can possibly be seen or appreciated.

Most of our readers will have experienced something like the following:—

A piece of rich and beautiful oriental embroidery is brought out of the drawing-room of a country house to decorate some barn, which for the nonce is to serve as a concert-room, and one is ashamed to find how many times one has seen that bit of embroidery before in the drawing-room from which it has been taken without having in the faintest degree appreciated its beauty.

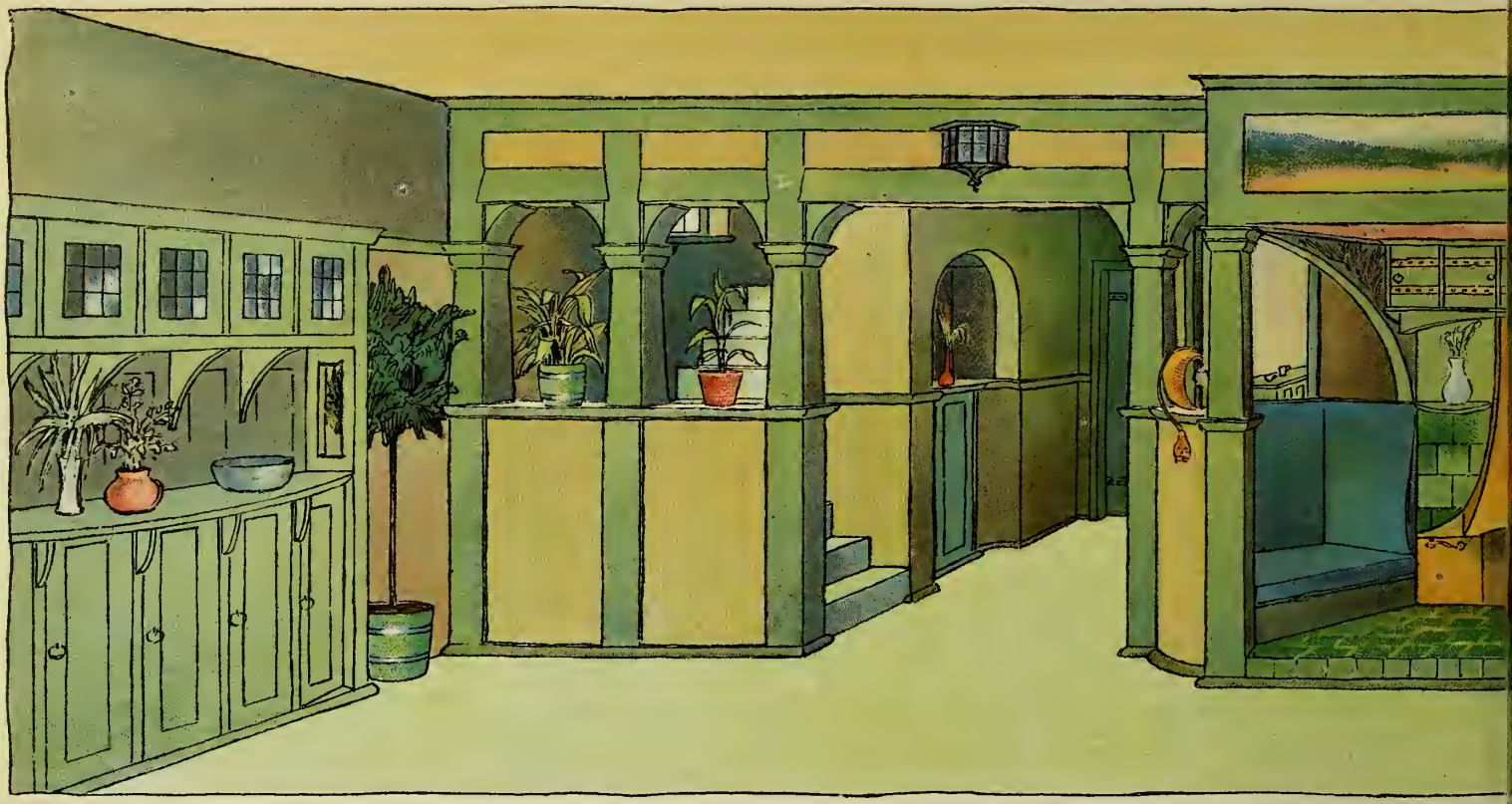
Another very fruitful cause of failure in modern architecture is the lack of study of the proper massing of light and shade, and of the forms of the masses of both. Let us take our enriched late Norman doorway again and its surrounding walls as an example. Imagine how the effect of the whole would be lost

if the mass of shade produced by the recessing of the door were broken up into little shapeless blotches and patches, and distributed impartially over the whole surface of the building. This again is a suggestion which sounds ridiculous, and yet this is what the modern architect does in his ordinary practice by scattering meaningless bits of ornament and enrichment here and there without sense of grouping or massing, by senselessly broken pediments and blocked columns, and by projections of one sort or another, without any thought of the presence and forms of the shadows they will cast, or much consideration of the massing of his lights and shades. These are in some measure points to be considered in domestic interiors. The most happy results are not to be obtained by having all parts of a room or a house equally lit either by daylight or artificial light. In both cases the light and shade need to be very carefully studied. Generally speaking, it is more pleasant to enter a room through a space which is rather less well lit than the room itself, and, to be most effective, recesses and alcoves should be either rather lighter or rather darker than the body of the room. This is a point which no good architect would lose sight of in church work, but which is often thought to be negligible in domestic work.

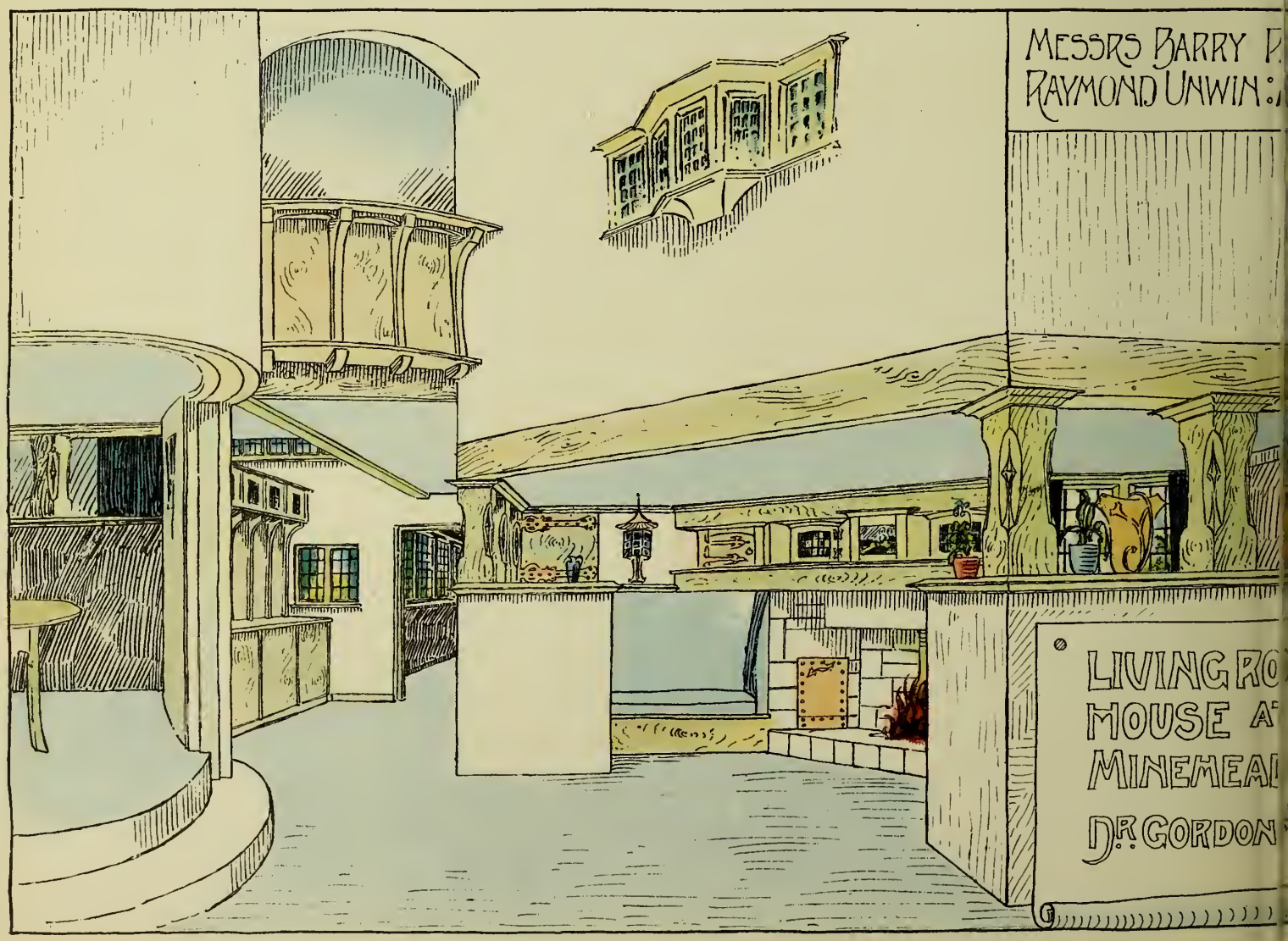
Easel pictures are usually the most important element in the decoration of a domestic interior, and these are still almost invariably hung too high, often too high to be seen to the best advantage even when standing, and always too high to be seen to the best advantage when sitting. In most rooms one feels to drop below one's proper relation to the things in the room when one sinks into a chair. We should realise that we are sitting in our homes five hours for every one that we are standing, and should arrange them to look their best when seen from this position.

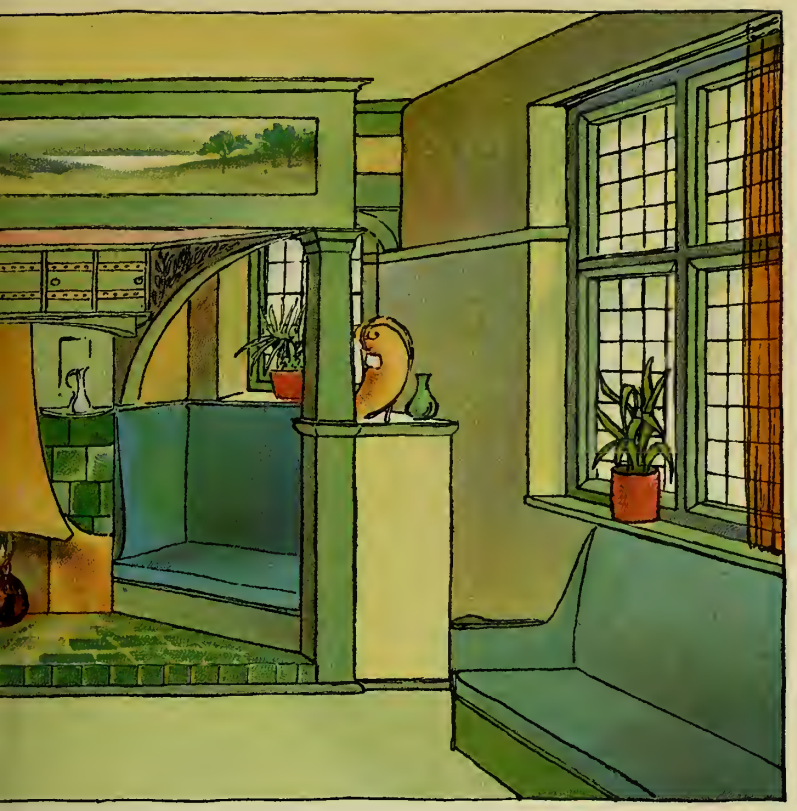
Fig. 177a.

Finally, we would call attention to the gain in economy, in space, money, and trouble of cleaning and dusting, obtained by having fitments rather than loose furniture. The custom is to design furniture which is supposed to come in conveniently anywhere, and to accommodate anything one may wish to stow away in it, and experience proves that it generally comes in but inconveniently everywhere, and is most unaccommodating in the way it receives those particular things which we find we want it to hold. It is hoped that the accompanying illustrations (see Plate VII. and Fig. 177A) will show that furniture can be economically and happily fitted into all sorts of spaces and recesses, over fireplaces, under stairs, in the walls, and between the points of support. How great is the artistic and utilitarian gain to the whole when the furniture has been designed for the place which it is to fill in the building, and when the place has been arranged for it in designing the building itself.



: SKETCH FOR LIVING ROOM : HOUSE AT RUGBY FOR H·V





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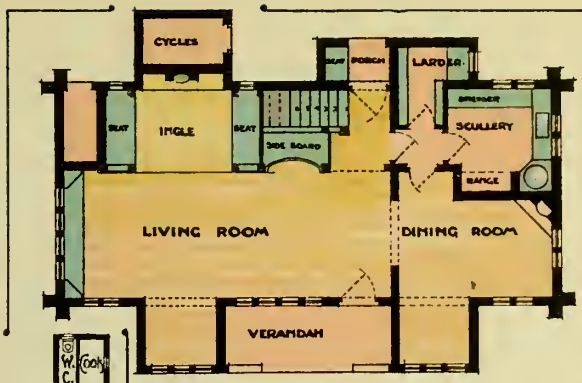
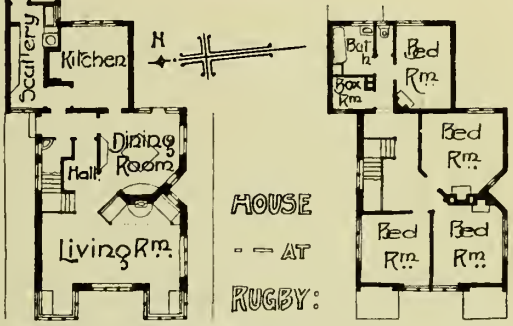


Plan of House at Bamford.



Ground Plan & 1st Floor Plan:

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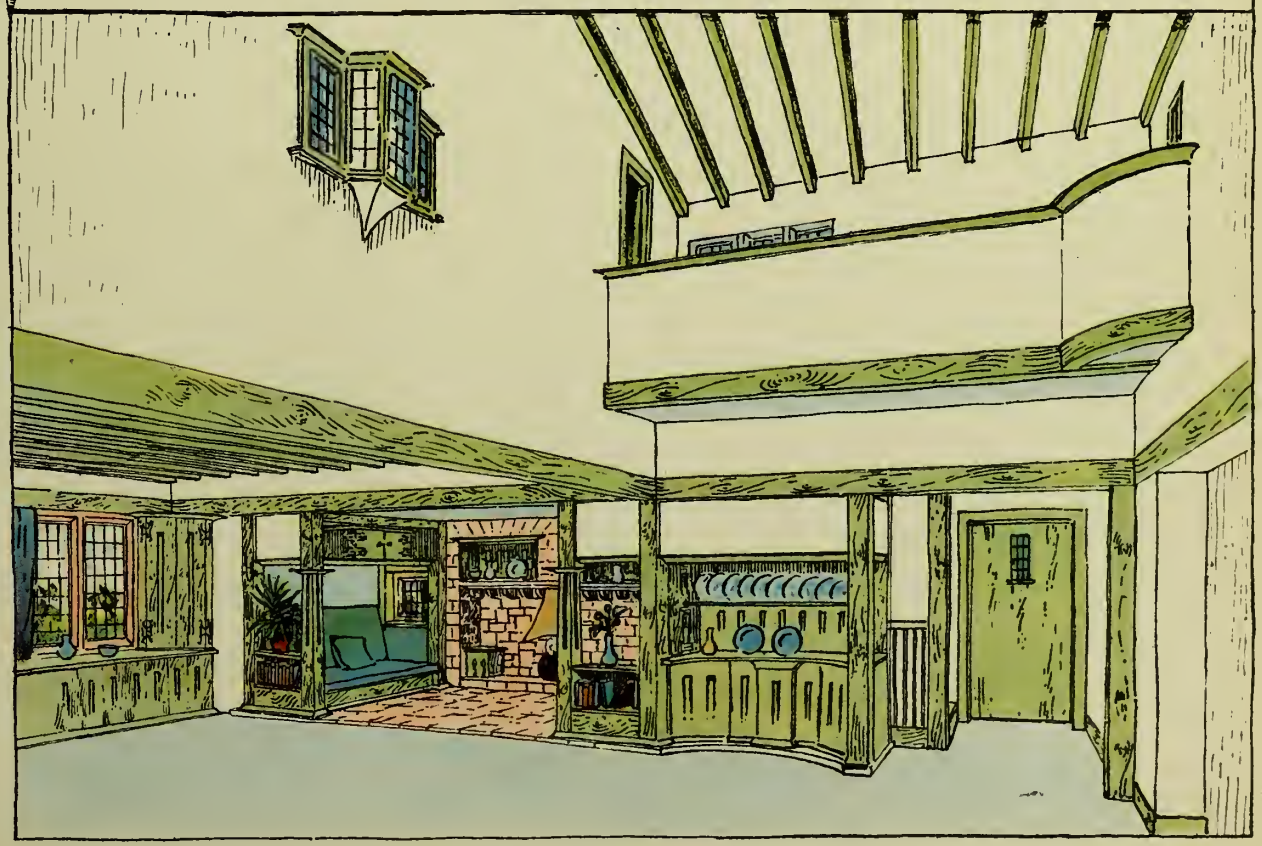
PLATE 7.

LIVING ROOM IN HOUSE AT BAMFORD FOR MRS ASHWORTH



CHAPTER XIV

INTERNAL DOMESTIC FITTINGS

(Contributed by W. H. Brown, F.S.I.)

In selecting Ironmongery, such as door and window furniture, whether it be for a public or a domestic building, the architect cannot be too careful that the various fittings are suitable for their purpose, and that they are of first-class quality. Inferior ironmongery is a source of continual annoyance. It is proposed in the present chapter to deal with this subject in the following order—Hinges, Latches, Locks and Furniture, Bolts and Fastenings; and to explain the different varieties of each in general use, and the positions for which they are suitable.

Hinges.—Iron hinges are generally used for soft-wood doors, but in good work they should be of wrought and not cast iron, the extra cost of the former being more than compensated by their greater durability and ease and freedom of working.

For hard-wood doors, brass, bronze, or gun-metal hinges should be selected generally, except in the case of Gothic or other ornamental strap hinges, when the selection of the metal will be governed by taste or price, or by a combination of these two considerations. In specifying hinges, or indeed any ironmongery, it should be borne in mind that these goods are supplied by many different firms and in a great variety of qualities. When it is not desired to stipulate that the ironmongery shall be supplied by any particular firm, great care should be taken to indicate the quality, and the best way to do this is to specify that they be equal to a sample in the architect's office, and to see that the goods supplied comply with this stipulation.

Among hinges, one of the most generally known is the simple ⊤ or cross garnet, illustrated by Fig. 178 (A), its chief use being for ledged and braced doors, the edge of these doors not allowing sufficient fixing for butt hinges. The heavier qualities are also suitable for framed doors where greater security of fixing is required than can be obtained with a butt. H. and H. L. hinges, as shown in Fig. 35 (B and C), are also very suitable for this purpose, and have this additional advantage, that they can be fixed in any position on the hanging stile, and need not be opposite a top, bottom, or other rail.

For gates, stable doors, etc., the simplest form of hinge is the hook and strap, Fig. 178 (E and F), made with the hook on a plate, on a driving staple (E), or on a forged two-way strap (F) for building in. This form of hinge, on account of its simplicity, readily lends itself to special design by the architect where this is desired. For heavy gates, stable doors, and similar positions, strap hinges are made with a double strap, either of equal or unequal length (G). One of the best hinges for gates and external heavy doors, to coach-houses, stables, etc., is Collinge's spherical gate hinge, shown at H in Fig. 178, made on the cup-and-ball principle, the cup being on the post or pier and the ball-shaped pin on the gate strap. It will be noticed that the pin has a projecting lip, fitted with a leather washer to exclude water and dirt from the cup, which is filled with oil. These hinges are extremely durable and easy in their working. Fig. 178 (I) illustrates Collinge's double-strap hinge for swing gates. The joint of the top hinge is similar to that last described, and the bottom works on two pins, making the gate self-closing. Messrs. James Hill & Co.'s self-closing hinge for swing gates, illustrated at J, comprises a top hinge with cup joint and a bottom self-closing hinge consisting of two inverted half cups on the gate, working on two balls on the post or pier. One pair works when the gate is swung inwards, and the other pair when it is swung outwards, both coming together only when the gate is closed.

While on the subject of strap hinges it will be well, perhaps, to mention Gothic and other ornamental hinges. These in an age of hand labour were a natural artistic development of a strap hinge, but in modern work they too often consist of a pair of butt hinges and ornamental hinge fronts, as they are termed, which are mere shams, having no connection whatever with the actual hinge.

The most generally used hinge of modern times is undoubtedly the butt hinge, as shown at G in Fig. 179, which is made in a variety of metals and sizes suitable for any framed door. These hinges are screwed to the edge of the door and to the rebate of the frame or lining. When brass butts are used for heavy doors, or where there is much wear, they should be fitted with double steel washers, as shown at D, to form the wearing surfaces in each joint of the knuckle. Projecting butts (Fig. 179, D) are made with wider cheeks, so as to project beyond the face of the door in order to allow it to open clear of architrave or other projection.

Rising butts, as at A, have a spiral joint on the

knuckle, which raises the door as it is opened clear of carpets, etc., also giving it a tendency to close by its own weight. Where rising butts are used, the top of door and the top rebate of frame must be splayed.

Ball-bearing butts have two cup-and-ball joints on the knuckle, whereby friction is reduced to a minimum. Fig. 179, C, illustrates an improved ball-bearing hinge manufactured by Messrs. James Hill & Co. The ball races which are adjustable are kept well apart, and the cups made separately, which enables them to be properly hardened.

Cranked butts are only required for special positions, and have to be made to order.

Back-flap hinges (B) are made to allow of the leaves or flaps folding back against each other. Counter hinges (E) are constructed with a double knuckle and two pins working in a loose socket. The hinge is let in flush with the counter top, with the knuckles on the under side, so that, although the flap can be opened right back on to the counter top, there will be no projection above the counter when it is closed. Fig. 179, H, shows an egg joint pew hinge, which is practically a projecting butt with a strong knuckle shaped so as not to tear garments.

Parliament hinges (F) are made to allow of shutters or doors opening clear of a reveal, and lying on the face of the wall, as shown at Fig. 179, I.

Of door springs and spring hinges there are a great many varieties on the market. Spring hinges should always be used in new work in preference to door springs, except for the commoner description of doors or in unimportant situations. Door springs are unsightly, and generally speaking their unsightliness increases with their effectiveness.

All springs and spring hinges should, in good work, have a check action — that is to say, when the door is within a few inches of the closing point the spring should be checked and the door allowed to close gently, to avoid banging backwards and forwards in the case of swing doors, and slamming in the case of doors opening one way only.

The check action is generally obtained by means of a

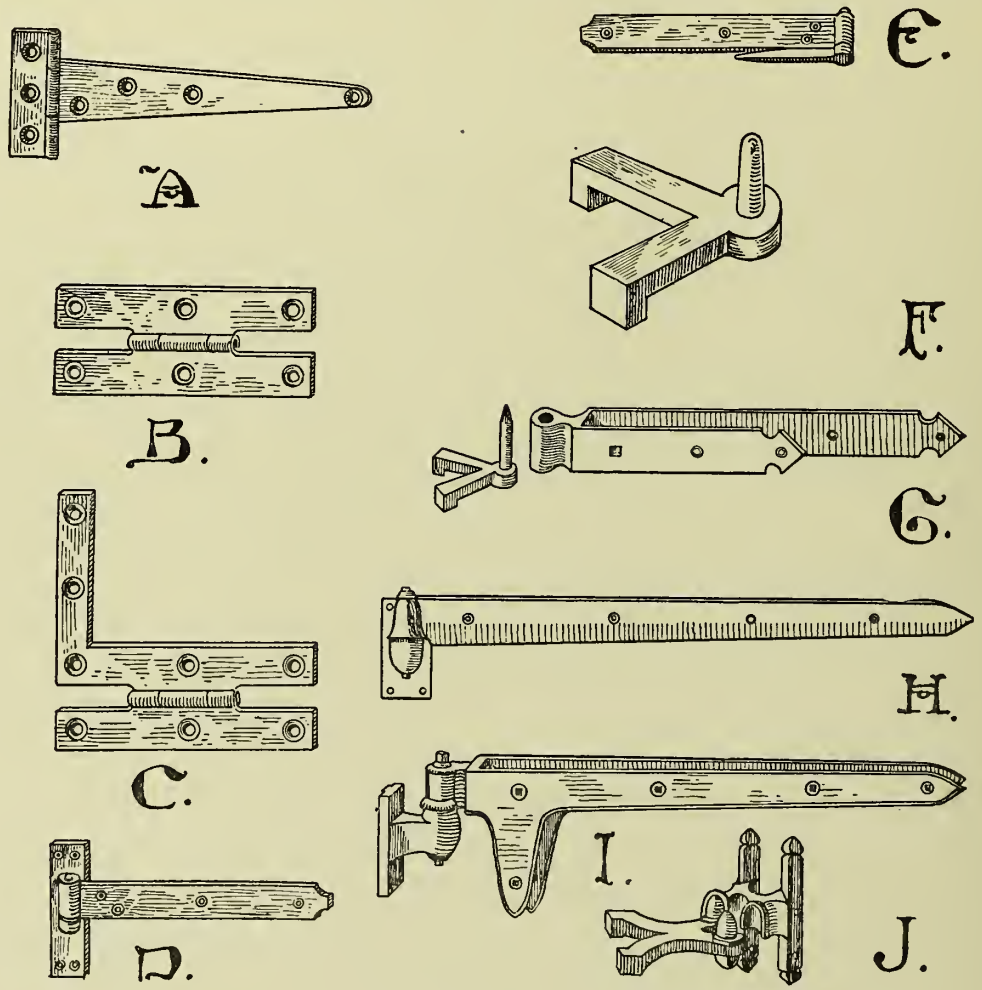


Fig. 178.

piston coming in contact with a cushion of air in a piston box, from which the air can only escape slowly. Thus the violent swing of the door is checked and slowed when near the closing point.

be very slightly extended, and fixed as shown at Fig. 180, A, and care should be taken that it is fixed so that opening the door winds the spring up.

A helical spring is shown at B. The spring is

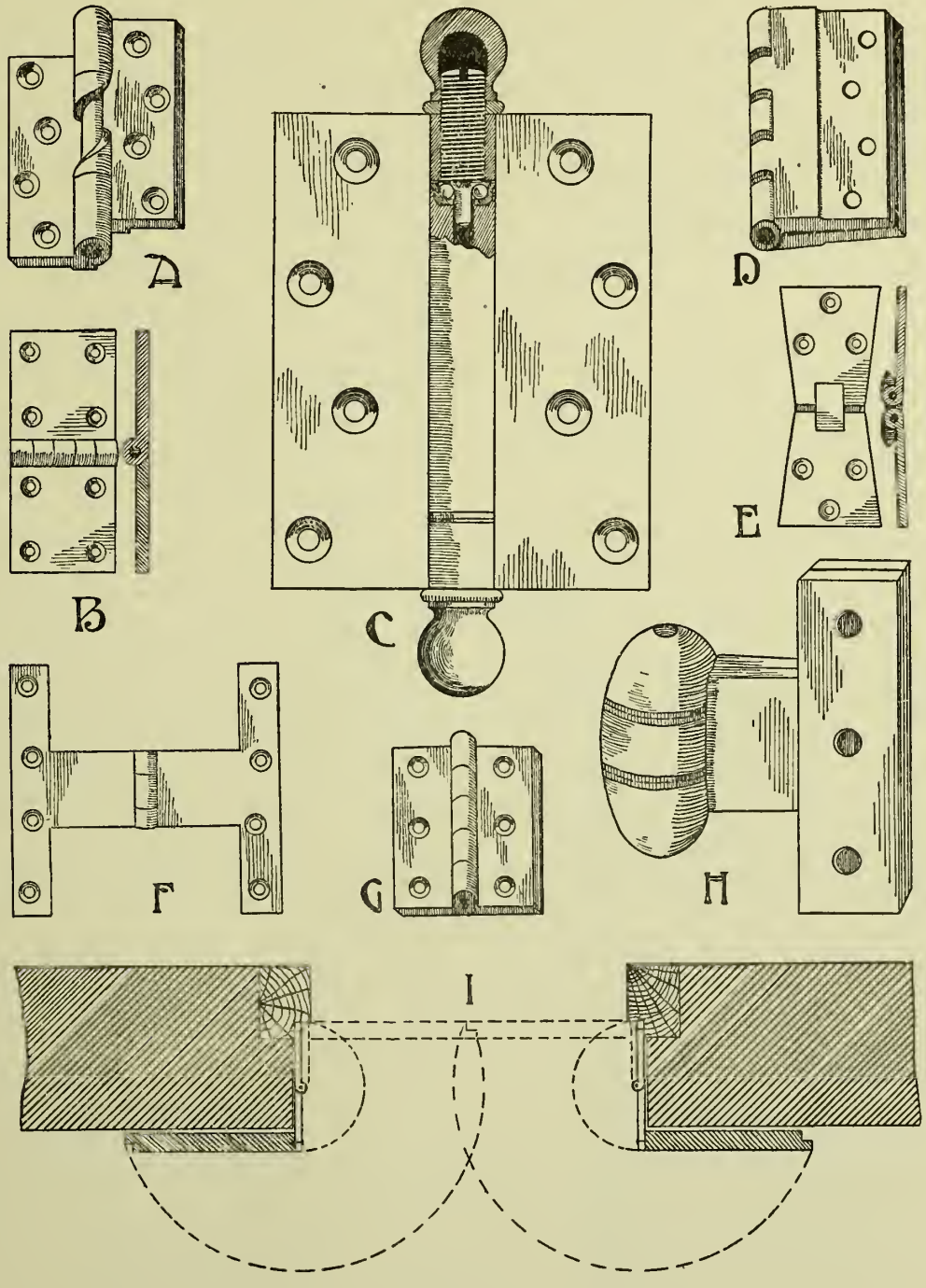


Fig. 179.

One of the simplest and most effective springs for unimportant positions is the ordinary adjustable coil spring, fixed at one end to the frame and at the other to the hanging stile. The spring is often wrongly fixed with the ends parallel to the edge of door, causing the spring to follow the form of a letter S. It should

enclosed in the barrel attached to the jamb, and can be readily adjusted as to strength. There is a small wheel in the end of the arm, which runs on a plate screwed to one of the rails of the door.

Weston's steel-rod door spring is illustrated at C. The spring is obtained by means of a twist in the rod

itself, and its strength can be regulated by means of the capstan head.

Figs. 181 and 182 illustrate respectively the "Improved Norton" and the "Blount" door springs and pueumatic

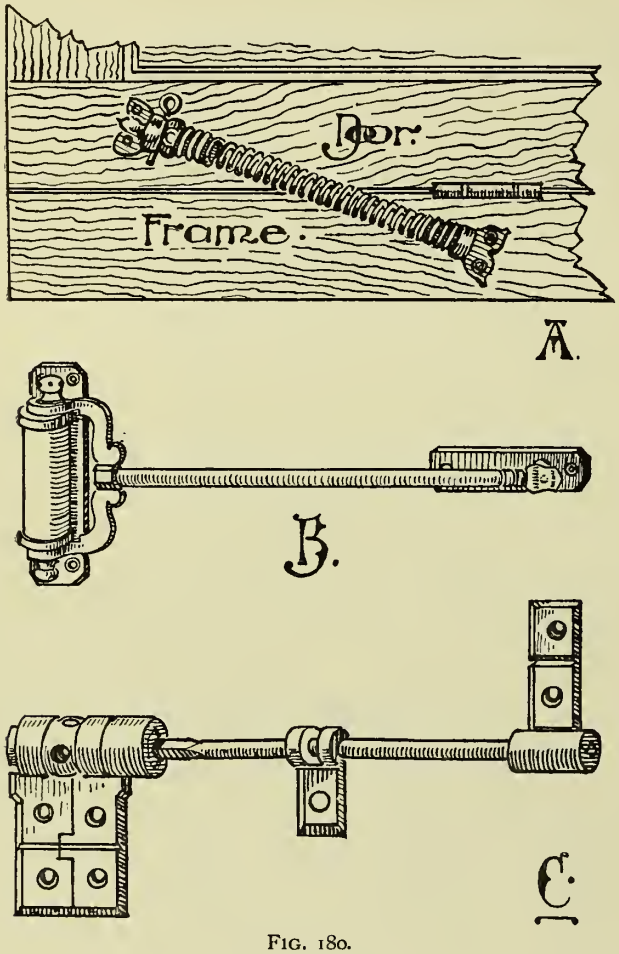


Fig. 180.

checks, while Fig. 183 illustrates the "Bardsley" of which Messrs. Nettlefold & Sons are the sole agents. This spring has an oil check, which it is claimed is

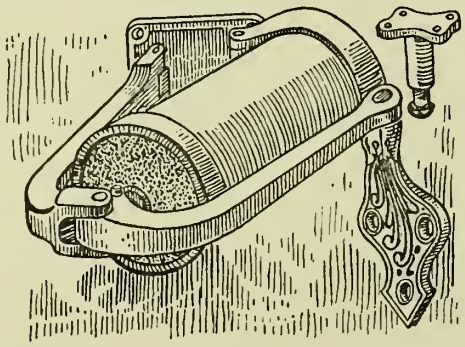


Fig. 181.

superior to the pueumatic check, and it has a releasing device by means of which the checking power is removed when the door is nearly closed, thus allowing the spring to exert its full power in order to latch the door. There are several other makes of check springs differing in details.

Among the several varieties of spring hinges the neatest and most effectual are those contained in boxes

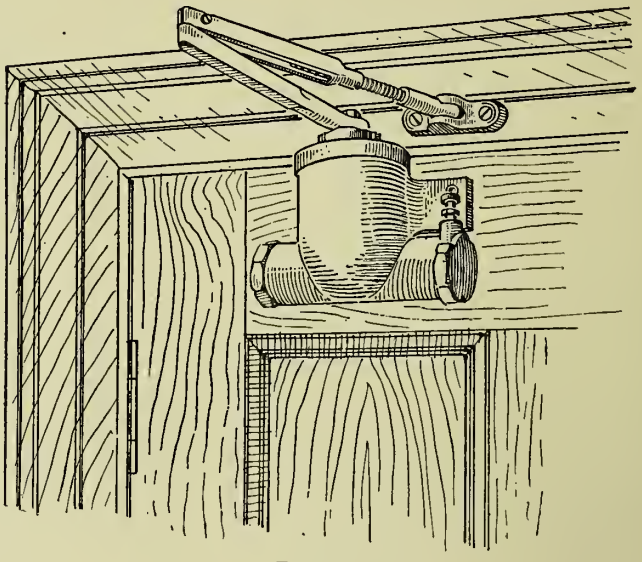


Fig. 182.

let in flush with the floor or paving, and having top centres secured to top of frame. They can be had either with or without check action. There are several makes of these hinges, all very similar in outward appearance, but differing in construction. They are made with either single or double action, the former for doors opening one way only, the latter for swing doors. Fig. 184 is a plan, with top plate removed, showing the construction of "Smith's" double action hinge, by which it will be seen that on opening the door in either direction a set of spring rings are forced open. In the "Climax," illustrated by Fig. 185, the power is obtained by means of two spiral springs. Both "Smiths" and the "Climax" are made in

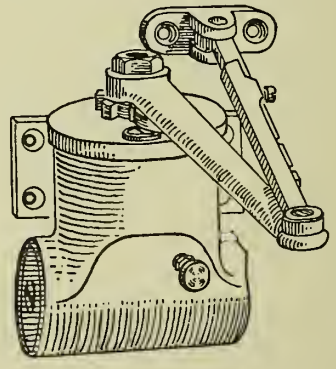


Fig. 183.

varying strengths to suit doors of different weight. "Hill's Improved Swing Door Centres," illustrated by Fig. 186, are actuated by a single spiral spring, the strength of which can be adjusted to suit varying

weights of doors by means of the capstan head B; while the capstan headed screw marked A enables the door to be set perfectly true, and so saves much time in fixing. The "Slave" single-action and the "Slave" double-action floor springs with pneumatic checks are respectively illustrated at A and B in Fig. 187.

The floor springs patented and manufactured by Robert Adams comprise several patterns suitable for various positions. They are made either with or without checks, and the checks are either pneumatic or hydraulic. The latter pattern is generally to be preferred, as, the liquid being oil, the internal parts are always kept lubricated. Fig. 188, A and B, illustrate respectively the "Crown Victor" (double action) and the "London Victor" (single action). Both can be had either with or without oil checks, and it will be noticed that these hinges take up much less space than most other patterns. The

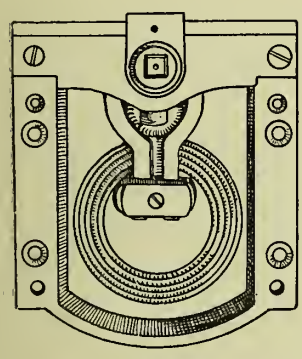


Fig. 184.

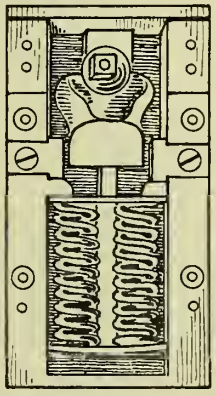


Fig. 185.

special features of the hinge comprise a wide angle of opening, (in the case of the "Crown" the door can be opened to an angle of 135° and in the case of the "London" to an angle of 180°); a large size internal spring A, which ensures great elasticity and durability; a capstan screw C, by means of which the closing power can be regulated; an automatic compensating action, which prevents any slackness from wear; a safety valve to prevent injury by unduly violent use; and a screw S, by means of which the speed of closing may be regulated.

Fig. 188, D, illustrates the "King Victor" double-action floor spring for exposed situations. This hinge is designed specially to resist strong currents of wind blowing in one direction, but to open easily the reverse way. This is effected by means of separate and independent closing springs, only one of which comes into action at a time, according as the door is opened in or out, and each of which can be regulated for strength independently. The spring is provided with a silent oil check, and possesses most of the advantages claimed for the "Crown." It will not, however, open to quite such a wide angle, and a stop should be provided to prevent breakage by undue violence. The "Hurricane Victor," specially designed to stand exceptional wear and to open 135°, is shown at C, but a stop should be provided to prevent its opening beyond this. Each spring can be independently adjusted, so that the door may be set to resist a hurricane on one side and be easily opened in the opposite direction. This hinge

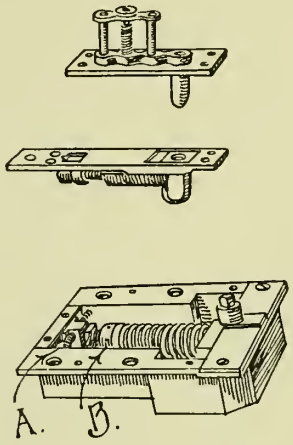


Fig. 186.

is without the check action. Special patterns are catalogued for situations where the ordinary floor springs cannot be employed, as, for example, immediately over a girder. The several shoes and top centres for use with the "Victor" hinges include adjustable

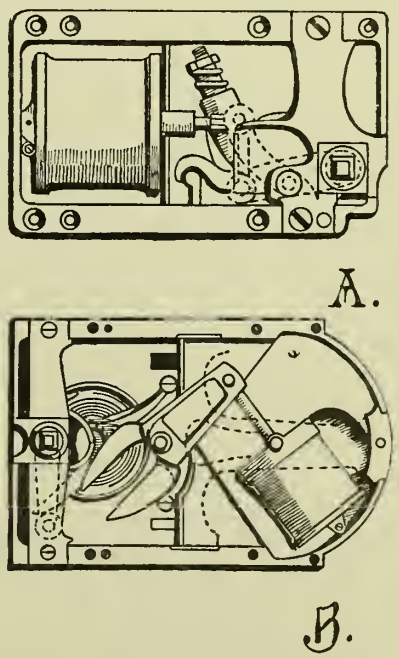


Fig. 187.

patterns, by means of which the door can be adjusted both laterally and vertically after the hinge is fixed.

Water-tight floor springs have a groove running round the flange of box, which is filled with rubber or other suitable substance to form a water-tight packing when the cover-plate is screwed on.

It should be noted that some of these hinges have special outer boxes for fixing in floors other than wood. Fig. 189, A, is a sketch of Smith's floor spring, showing the shoe for door, and is typical of this type of hinge. Fig. 189, B, shows a plain and C an adjustable top centre.

Of spring hinges other than floor springs, one of the best known is Gerish's. The single-action hinge is shown at Fig. 190, A, and the double action at B. The spring is contained in a cylinder, and is let into a circular mortice in the door frame. A chain is attached

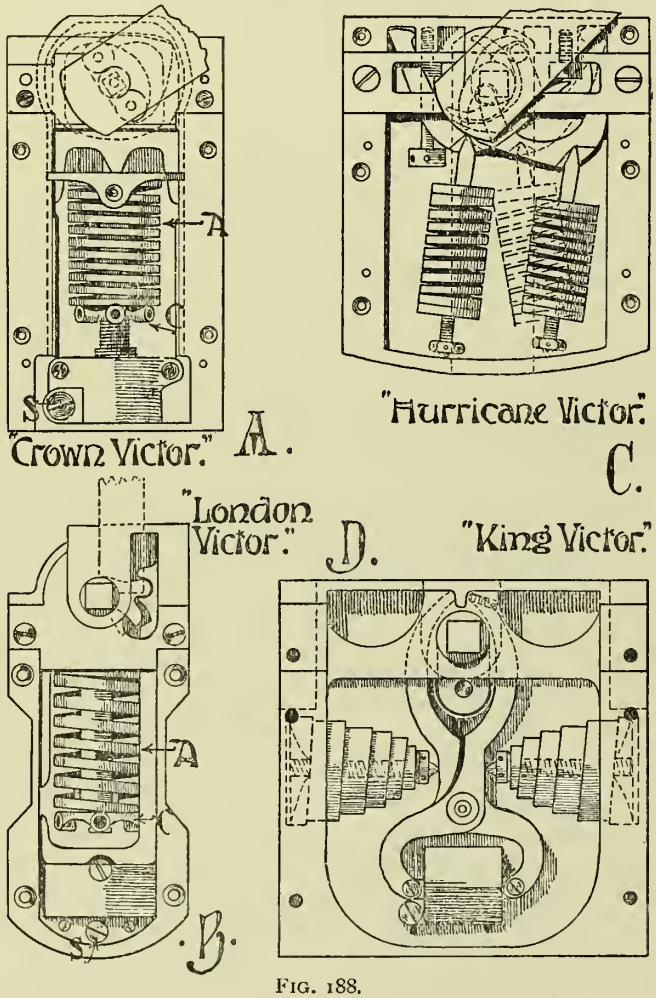


Fig. 188.

to the spring and passes through a hole in the hinge-plate attached to the frame, and in the case of double-action hinges through the middle plate also, and is attached to the plate screwed to edge of door. The double-action hinge consists of two knuckles, one of which comes into play when the door is opened in one direction, and the other when it is opened in the other direction. A pair of double-action spring hinges is usually considered to consist of one spring hinge and one blank. Single and double-action helical spring butts are illustrated at C and D, and the double blank hinge at E. The helical spring or springs are contained in the cylinders. These hinges can be had with capstan heads for regulating the strength as illustrated, or non-regulating. The action of the single-acting hinge will be obvious from the illustration; the double-action hinge consists of two cylinders, and three plates corresponding to the two knuckles and three plates of Gerish's hinge, the only difference being that in the one case the spring is contained in the hinge joint and in the other it is separate. F and G illustrate an improved double-action spring hinge and blank manufactured by Messrs. Nettlefold & Sons, the advantages claimed for it being rapidity of fixing, neater appearance than the three leaf var eties, and that, unlike them, it prevents sagging of the door. The blanks are on similar principles to the hinge.

The "Victor" butt spring for single-acting doors, as

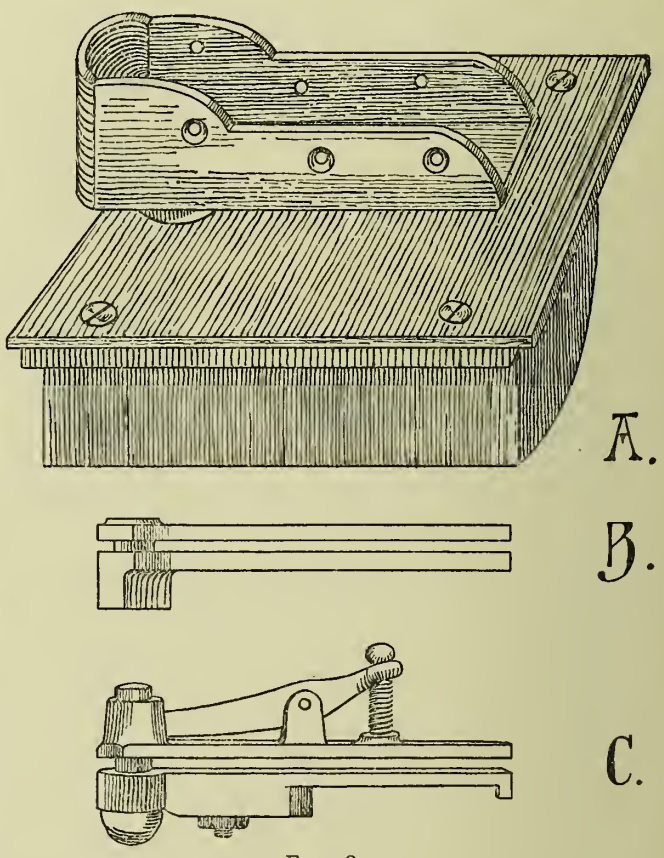


Fig. 189.

shown in Fig. 190, H, manufactured by Robert Adams, is made with a silent check action, and the door can be thrown fully back. This hinge is fixed near the bottom of door, and an ordinary butt is used at the top.

Most of these hinges are without check action, but an independent door check such as the "Magic" (I), can be used in the case of single-action doors, or one of the many door slams on the market, such as that shown at J, may be used.

Fig. 190, K, represents the special "sympathetic" door gear for opening and closing double-hung doors simultaneously. It can be adapted to open both leaves

at the same time either in the same or opposite directions.

The many varieties of hinges which are specially made for fittings and cabinet purposes are scarcely within the scope of this paper. They can be selected from the catalogue of any first class firm dealing with this class of goods.

In dealing with furniture and fastenings, money will be well spent in selecting the best. Where economy is a point to be considered it may be obtained by simplicity of construction, but the workmanship and material should be of the best. Where the very cheap locks fail most is in the inferior workmanship and materials, and the extreme lightness of the working parts.

Locks must be chosen according to their position and use. In many situations the mechanism of a very elaborate lock would be quite thrown away.

Ordinary door locks are divided into two kinds as regards the method of fixing them in the door, namely, "Rim locks," which are fixed on the face of the door; and "Mortice locks," which are let into a mortice on the edge of the door. Each of these two kinds is again divided into "Dead-shot locks," or "Dead locks," as they are often called, "Latching locks," and "Two-bolts locks." A "Dead-shot lock" consists of one bolt actuated only by a key. A latching lock consists of a spring bolt actuated by a handle, but such that it can be locked by means of a key, rendering the handle inoperative. A two-bolt lock consists of a spring bolt actuated by a handle and a dead-shot bolt. A third variety is the ordinary night latch for street

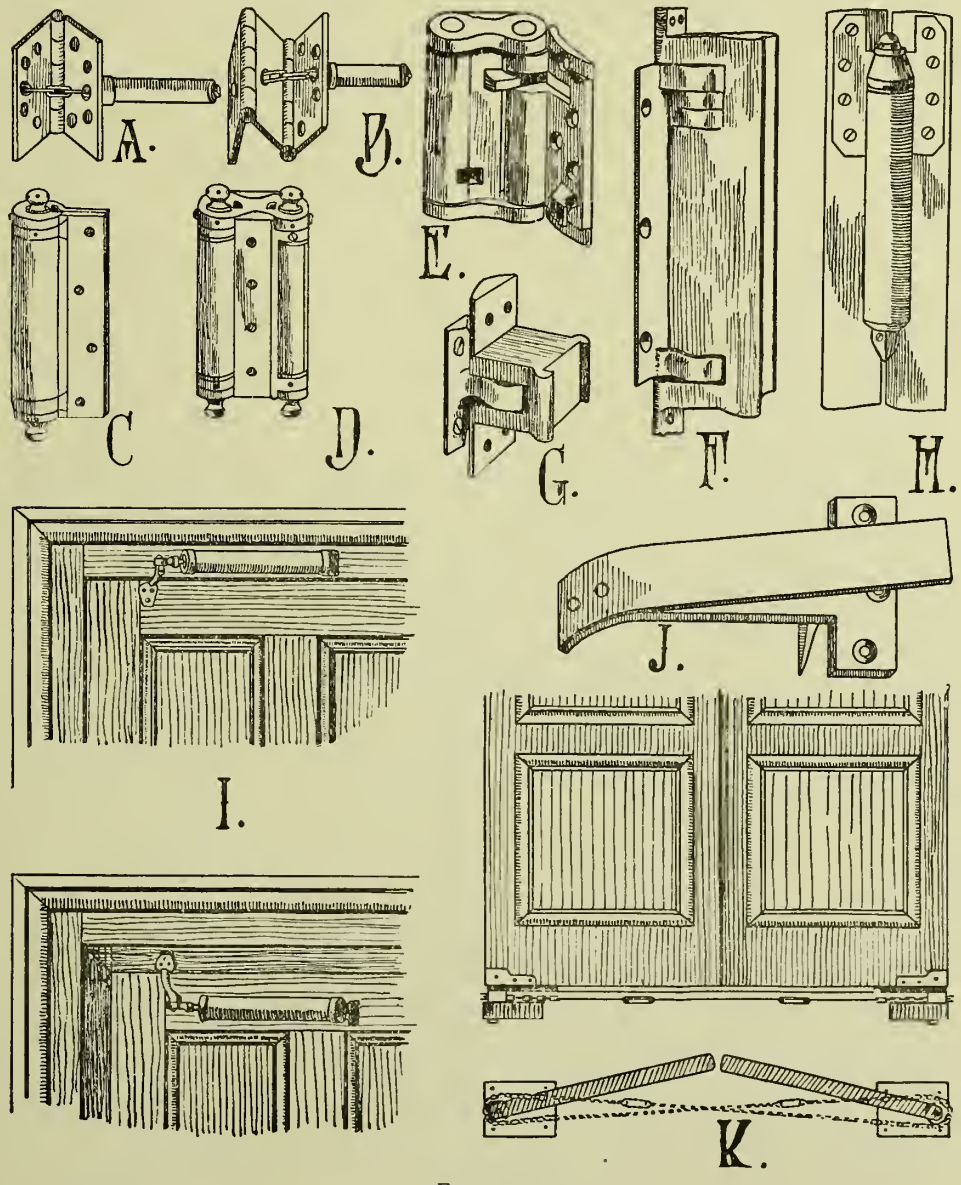


Fig. 190.

doors, which consists of a spring bolt actuated by a handle on the inside and a key without,—generally speaking, however, the key in no sense locks this bolt, the locking being done by means of a small catch or pin on the inside, which renders both handle and key inoperative.

spring bolt actuated by a draw-back knob on the inside, with a hook or catch to hold the knob back when it is not required, and a key to lock the spring. Such are made as rim, mortice, or stock locks.

Fig. 191 illustrates, at A, B, C, D, and E respectively, a single-bolt iron-bound stock lock (A), a rim dead

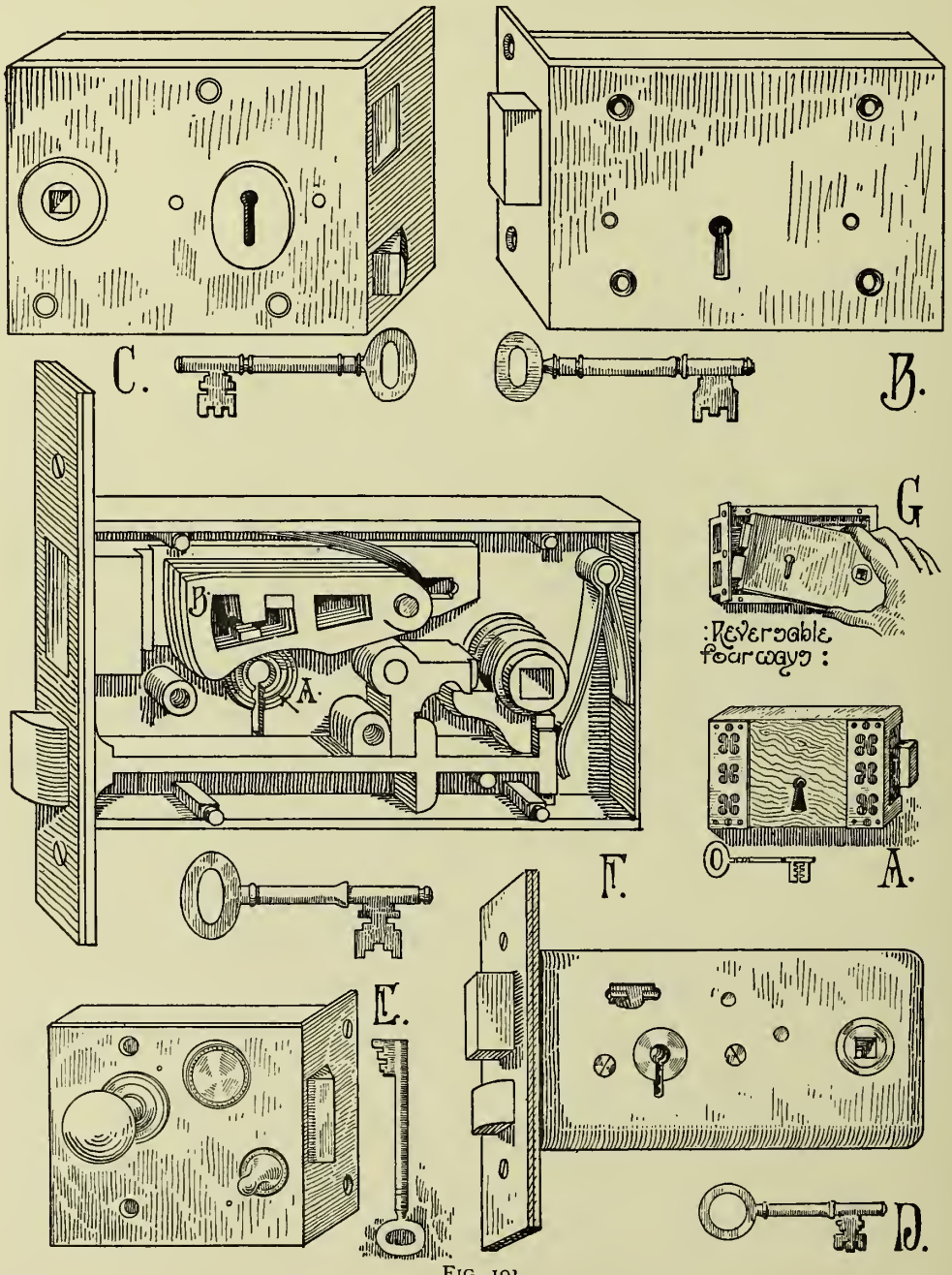


Fig. 191.

A stock lock is a rim lock in a hard wood instead of a metal case. It is used for stable, coach-house, and similar doors. The angles are sometimes iron bound for strength and protection. This lock is also largely used on church doors, the iron or metal corners generally being ornamental.

A draw-back lock for street doors consists of a

lock (B), a two-bolt rim lock (C), a two-bolt mortice lock (D), and a rim night latch (E). Mortice locks can also be had of an upright form, suitable for doors with narrow stiles, and centre bit mortice locks are made to fit into the cavity drilled by a centre bit.

Fig. 191, F, illustrates a simple pattern of a 4-lever mortice lock with reversible bolt for right or left-hand

doors, as manufactured by Messrs. Colledge & Bridgen, with the top plate removed. At A are the wards, which fit into corresponding notches on the key. These wards are attached to the front and back plates of the lock, and when they are cast in one piece they are called solid wards; B shows the levers or tumblers, having slots in them fitting over a projection on the bolt when the levers are at rest, as in the illustration. It will be noticed that they are all level on the under side, but project to different levels in the connecting slot. These projections have all to be raised to the same level by means of corresponding notches on the key before the projection on the bolt can pass from one end of the slot to the other and so allow the bolt to be shot. The levers are assisted by springs to return to their original position and so lock the bolt. The action of the latching bolt will be readily followed from the illustration.

Weighted locks are made to do away with all springs. They are suitable for use in schools, or in other situations where they are subject to hard wear.

The details of locks vary with different makers. Messrs. James Hill & Co.'s locks are all reversible for four different hands, with the keyhole always in the right position. In the case of mortice locks this result is obtained by simply reversing the latch bolt, as can be done in many other makes; but in the case of rim locks, in addition to reversing the latch it is necessary to turn over the body of the lock in the frame, which is made separate for this purpose, and both lock and latch bolts fit holes of similar size in the face plate (see Fig. 191, G). In Messrs. Hills' mortice locks the latch bolt is reversible without opening the lock.

Messrs. J. Kaye & Sons' locks have no slots in the levers, which form a dead prop against the bolt when the door is locked, making it impossible to force the bolt. Another advantage of this arrangement is that there is a large portion of the thick part of the bolt within the case when the door is locked (see Fig. 192), which illustrates their patent Yorkshire mortice lock, in which there is no projection on the edge of the door. The latch bolt occurs in the striking plate and not in the lock, while the patent handles are securely screwed to the door and cannot work loose, as they are not supported by the spindle, but the spindle is supported by the furniture.

Messrs. Nettlefold & Sons' patent lever mortice locks have the levers and springs in one piece of metal, thereby preventing all possibility of the levers separating themselves from the springs. The same firm's patent "Guardian" locks are secured by 5 or 6 levers and also by a "Guardian," which, rising by an incline directly any pressure is applied to the bolt in the attempt to pick the lock, grasps a stud on the lock case and prevents the bolt from moving; while directly pressure is withdrawn the Guardian resumes its original position.

Messrs. Chubb & Sons' patent "Detector" locks are made in dead, spring, or two-bolt rim and mortice locks, and all other kinds. The mechanism is such that any attempt to pick or open the lock by means of false keys brings into action the "Detector." The accidental trial of a wrong key may produce the same effect; and the next time the owner tries to open the lock with the proper key he finds it fast, thereby being made aware of the fact that the lock has been tampered with. By turning the proper key sharply, as though to lock the door a second time, the "detector" is released and the door can be unlocked in the usual manner.

Night latches are made either rim or mortice, for use on street doors. They generally consist of a spring bolt actuated on the inside by a handle and on the outside by a key, and are locked on the inside by a

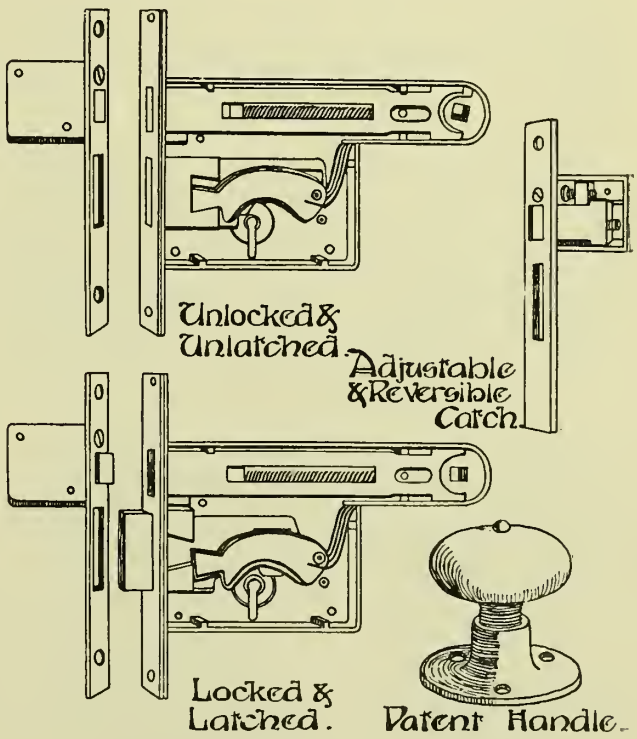


FIG. 192.

catch or loose pin. The better kinds are made on the "Detector," "Protector," "Guardian," or some similar principle according to the manufacturer. Hills' patent cylindric lever rim night latch has the advantage over other kinds that it can be locked from the outside by a short key, the length of which is independent of the thickness of the door.

Yale locks are cylindrical locks actuated by a small flat key with an irregular edge. The keyway is in a revolving plug, and the key has to raise a set of pin tumblers working in chambers, formed partly in the plug and partly in the cylinders, before the bolt can be shot. This lock affords great security, and can be master keyed if desired.

Lt.-Colonel Wethered's patent automatic and reversible locks, manufactured specially for the patentee by

Messrs. Nettlefold & Sons, consist of a series of self-locking latches. In these locks there is a pawl above the bolt and projecting through the face plate of the lock. On the door being closed this pawl engages with an incline on the striking plate, and being raised thereby releases the spring bolt. These locks are made to open by means of a key only, or can be fitted with patent locking clamp furniture, by means of which, when the clamp is pulled outwards, the lock can be used as an ordinary room door lock. When the clamp is pushed in the handles become inoperative and the door can only be opened by means of the key.

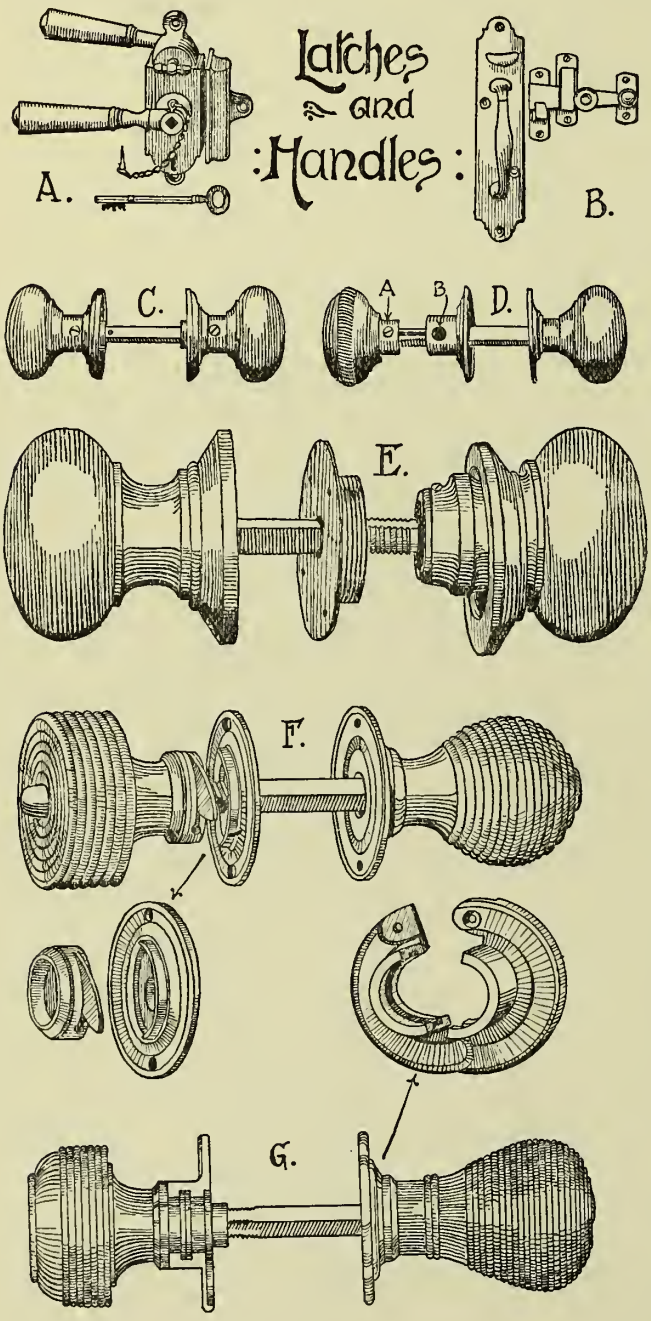


Fig. 193.

When it is desired to leave the door so that entrance can only be obtained with the key, the door must first be locked by the furniture, and then opened with the key and pulled to on going out. This operation prevents the possibility of locking oneself out without having the key in one's possession. These locks are made in various forms suitable for different purposes and positions.

Most first-class locks can be made in suites with master keys,—that is to say, that all the locks in the suite differ (*i.e.* no two locks can be opened by the same key), but all can be opened by a master key, which is also capable of double locking them, so that none of the other keys will open them until they have been released by the master key.

Locks can also be made with two, three, or four degrees of mastership; that is to say, they can be divided into sections, sub-sections, and divisions of sub-sections. Each division has its master key, which we will call a divisional master capable of unlocking all doors in the section, and also of locking out all the other separate keys; each subsection has a sub-sectional master capable of unlocking all doors in its subsection, and of locking out the divisional master and ordinary keys; each section has a sectional master capable of unlocking all doors in its section, and of locking out the subsectional and divisional masters and ordinary keys; while above all is a grand master key, capable of unlocking the whole of the doors and also of locking out all keys below it.

Messrs. Colledge & Bridgen's "Securitas" patent check-action mortice locks are made to differ and master as required, and in this lock the grand master key is made larger than the ordinary keys, and it is therefore impossible to convert an ordinary key into a grand master key by filing.

Fig. 193, A, represents a shop door latch with lever handles. These are made either locking (as illustrated) or non-locking. The form of handle shown is one largely used for ordinary door locks on the Continent, and has the advantages that it is easily grasped and is capable of highly artistic treatment; but on the other hand, it is obtrusive and apt to tear the clothing of persons using the door. Ornamental Suffolk latches (B) are now largely used for shop doors.

Door furniture should be well and substantially made, of suitable materials and design for its particular position. Beyond this it is a matter for individual selection; but a word is necessary on the methods of attachment of the handles of ordinary door furniture. There are now so many simple and effective devices for making these perfectly secure and preventing their working loose that it is quite inexcusable in good work to use the old-fashioned method, which consisted of a set screw in the neck of the handle engaging a sinking on the spindle (see Fig. 193, C). After a very short time these handles work loose, and are a continual source of annoyance. A very simple and effective method of fixing is shown on Fig. 193, D,

known as Mace's. The spindle is threaded on the angles, and two opposite sides are grooved. The method of fixing is as follows: The rose is placed in position but not fixed; the handle is then screwed on as far as is required, with the *hole* for set screw "A" opposite one of the grooved sides of spindle; the set screw is next inserted through the corresponding hole "B" in the collar of rose and screwed up tight; the rose is then turned round so that hole "B" is not opposite to set screw "A," and is screwed on to door in that position, so that it is impossible for the set screw to work loose. Fig. 193, E, shows "Nettlefold's" method, which it will be seen is similar to Mace's, but that the rose is in two parts, the outer portion being screwed on over the plate which is fixed to the door, thus both obscuring and securing the fixing screws.

The "Stanley" (Fig. 193, F) and the "Tudor" (G) lock furniture are two methods of dispensing entirely with the small set screw. The "Stanley" has a hinged wedge in the collar on the neck of the handle,

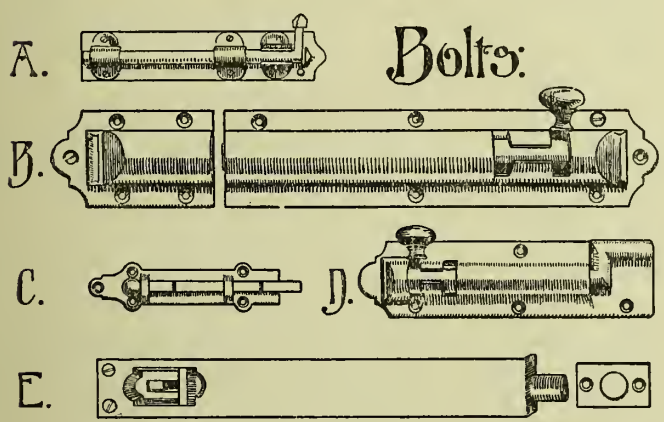


Fig. 194.

which fits into cross grooves on the spindle. When the handle is in the required position the rose is turned round until the half flange on it covers the wedge and holds it firmly in place, when it is screwed to the door. In the "Tudor" the collar on the neck of the handle and the adjustable collar on the spindle are each provided with flanges which are held together by the groove in the hinged rose. The "Stanley" is slightly more expensive than Mace's, and the "Tudor" considerably more so. There are other devices for securely fixing the handle to the spindle, but all cannot be described here.

An ordinary Norfolk or Suffolk latch is illustrated at (B), Fig. 193. It is the common form of latch for coal-house and outhouse doors, etc., but is adaptable to a variety of designs in various metals for more important positions. In good work nothing commoner than a plain wrought-iron latch should be specified for any position. Some of the cheap cast-iron varieties are absolutely worthless, although a serviceable latch is produced in malleable cast iron.

A tower bolt, a barrel bolt, a cranked tower bolt, a cranked barrel bolt, and a flush bolt, are illustrated respectively at A, B, C, D, and E, on Fig. 194. An indicating bolt for w.c.'s is shown by Fig. 195, whilst Fig. 196 shows the "Acme" dirt-excluding bolt socket for floors.

Espagnolette bolts are long bolts of the full height of door or casement, and are in common use in France. They are made to shoot either two or three-way by turning one handle or lever in the centre. A three-way

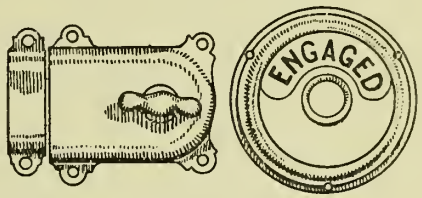


Fig. 195.

bolt is illustrated by Fig. 197, the third bolt being the short one to enter a staple on the other leaf of the doors or casements.

Among Robert Adams' "Victor" patents are a three-throw self-locking casement bolt, a weather-proof solid tongue concealed casement bolt shooting three ways and self locking, a similar pattern with removable key in place of handle, and a warehouse bolt to shoot two ways and lock the door by turning a handle on the out-

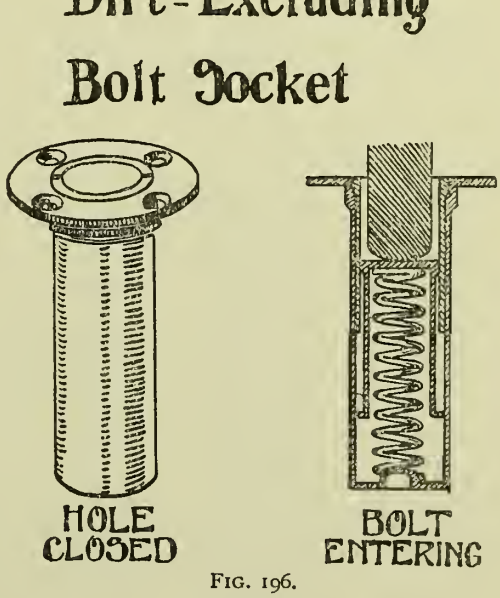


Fig. 196.

side, re-entry being effected only by a special key. This bolt is also made with a lever handle on the inside to act as an emergency bolt, pressure against the lever handle from the inside securing immediate exit, while the door can only be opened from the outside by a special key.

Messrs. James Hill & Co.'s combination bolts and locks for folding doors are made either to shoot two ways and with 2-bolt mortice lock or to shoot three ways and with 1-bolt mortice lock.

Panic bolts consist practically of an Espagnolette bolt with a projecting hinged bar across the whole

width of the door or doors on the inside, at a height of about 3 feet 6 inches above the floor, and connected to the opening levers which are so arranged that direct pressure against the bars withdraws the bolts and allows the doors to open. They cannot, however, be opened from the outside unless they are so arranged and provided with a key for this purpose. There are several makes of these bolts on the market, some of which can, if desired, be arranged to bolt and open from the outside, but never to be so locked as to prevent the doors from being opened by pressure on the bar inside. Fig. 198 illustrates a pair of "X-IT" panic bolts applied to a pair of swing doors. For a pair of folding doors opening one way only a single bolt with two cross arms is usually supplied, the ends of the arms fitting together on splay in order to convey the pressure from the bar on the free leaf to the bar on the bolted leaf. This arrangement acts well enough for emergency exits only, but the leaves require to be carefully closed in their right order, otherwise the ends of the cross bars will strike the edge of the opposite leaf, and on this account the arrangement is unsuitable for doors in regular use, especially if they are hung on spring hinges, in which case the edges of the leaves are soon much knocked about. In such cases the double bolts as supplied for swing doors are the proper pattern to use, and care must be taken in fixing them that the ends of the cross bars will not catch against the

Fig. 197.

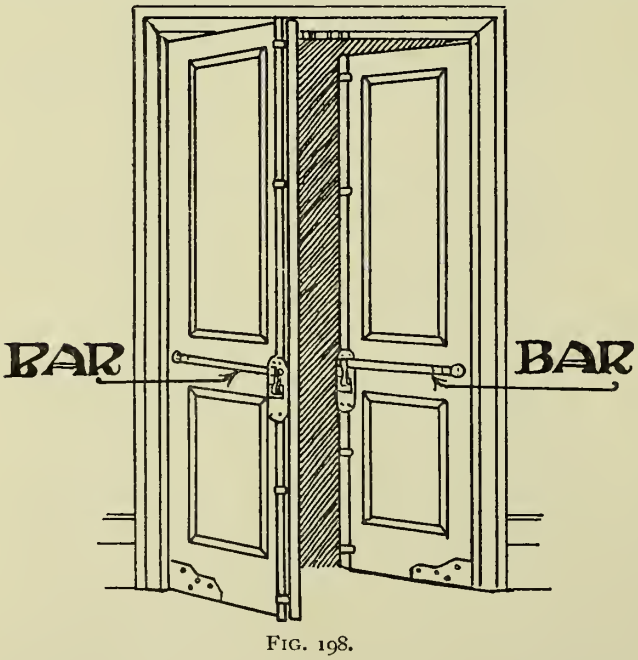


Fig. 198.

opposite leaves as the doors swing. For positions where it is not considered necessary to have the long cross bars the "Collins" panic bolt or panic mortice locks, manufactured by Messrs. Colledge & Bridgen, may be used. They are actuated from the inside by a small push plate, but are not adapted to be opened unconsciously by a panic-stricken crowd.

Of the fittings and fasteners for double-hung sash windows the two ordinary forms of sash fastener are shown in Fig. 199, A and B. Their weak point is that they can be operated from the outside by means of a knife or piece of flexible steel inserted between the meeting rails. Many devices have been invented to overcome this defect, one of the simplest of which consists of a guard arm actuated by the knob, but swinging round in the opposite direction against the back of the arm. The "Ives," an American pattern, is very simple and effective. It has an eccentric action, is self locking, and draws the sashes together. Robert Adams' "Triumph" patent is designed so that the window may be either quite closed or left slightly open for ventilation; but in neither case can it be opened from the outside. James Hill & Co. make a set of fittings, illustrated by Fig. 200, consisting of a combined sash lift and fastener on the lower sash, a top catch actuated by a cord which also lowers the top sash, and a pulley and cord for raising the top sash. The same firm also makes a top catch actuated by a special ash long arm, without cords and pulleys.

Meakin's sash fastener and opener consists of two top pulleys (one screwed on either side into the head of frame), two cord plates to secure the cord to the stiles of upper sash, and a catch on the meeting rail of the lower engaging a catch plate on one stile of the upper sash, the catch being actuated by the opening cord of the top sash, which passes over one pulley and under another in the body of the catch.

A spring catch for leaving windows either closed or slightly open for ventilation is shown at Fig. 199, C.

Sash pulleys, like all other fittings, should be well made. The cheapest should have brass face and wheels, steel axles, and brass bushes (that is, the holes in which the axle works should be lined with brass), and the checks should be of wrought iron. The better quality have gun-metal in place of brass, while some are made with roller bearings, and the best of all have ball bearings.

The usual casement furniture consists of fasteners and stays. The general form of fastener is known as a "Cockspur," and may be had in a variety of materials and designs, a plain pattern being illustrated by Fig. 199, D.

Casement stays, for holding the casement open to any desired degree, vary considerably in detail and their method of fastening, but all consist of some form of hinged bar. Fig. 199, E, shows a simple kind, with the hinge plate screwed to the bottom rail of casement and the pin plate to the sill. That shown at F also acts as a fastener.

A simple fanlight catch is shown by Fig. 199, G, the catch being attached to the top rail of fanlight. It can be opened by a long arm, which is a rod, usually of ash, with a brass hook on the end. A catch for use with lines and cleat is shown by Fig. 199, H.

Quadrant stays for fanlights, skylights, etc., consist in their simplest form of a quadrant shaped bar, such as is shown in Fig. 199, K, hinged to the sash and running on a pulley fixed to the frame. On the end of the stay is an eye for attaching a cord, which then passes over a pulley fixed to the frame and down to within reach of the ground, then back over another pulley, and is finally attached to an eye on the sash. Near the bottom of the cord a cleat is attached to the wall to secure it, so as to keep the sash shut or open at any desired angle. There are a number of different arrangements based on the quadrant principle for opening fanlights and skylights, some of them adapted for fanlights within reach and others to work with pulleys and cords. Fig. 199, L, illustrates a simple form for use within reach, made in four different styles to suit top, bottom, or centre-hung sashes opening either inwards or outwards. The illustration shows a bar for a top or centre-hung window opening outwards at bottom. In this case the hinged end of the stay bar is screwed to the sash.

Of those to open with cords, one of the simplest and best known is Leggott's system, which consists of a rack and pinion actuated by a worm (see Fig. 201, A). A neat and simple arrangement for fanlights is the "Invisible" patent opener illustrated at B. As the window is closed the screw disappears in a hole in the frame instead of projecting into the room. For heavy fanlights a side adjustment is provided to support the opposite side.

Screw and twin-screw pattern openers are adaptable to either fanlights or skylights opening in any direction.

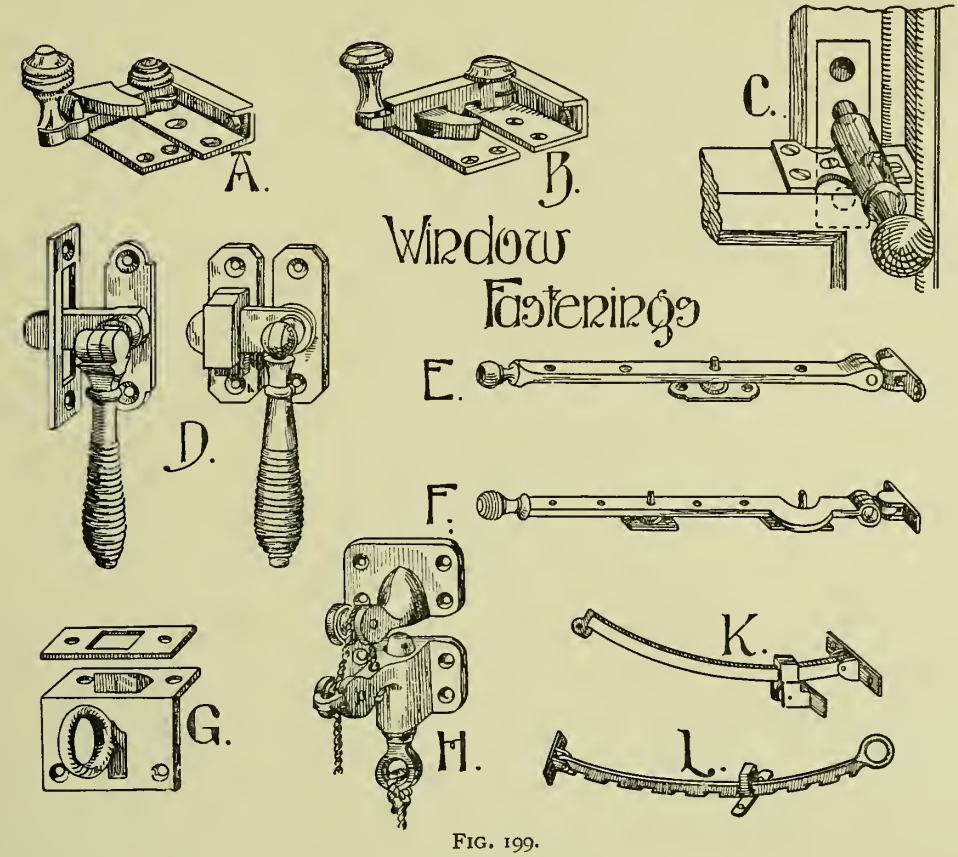


Fig. 199.

They have no projecting arms, and may be had to work either with an endless cord or with rod and handle. Fig. 201, C, illustrates a twin screw actuated by rod

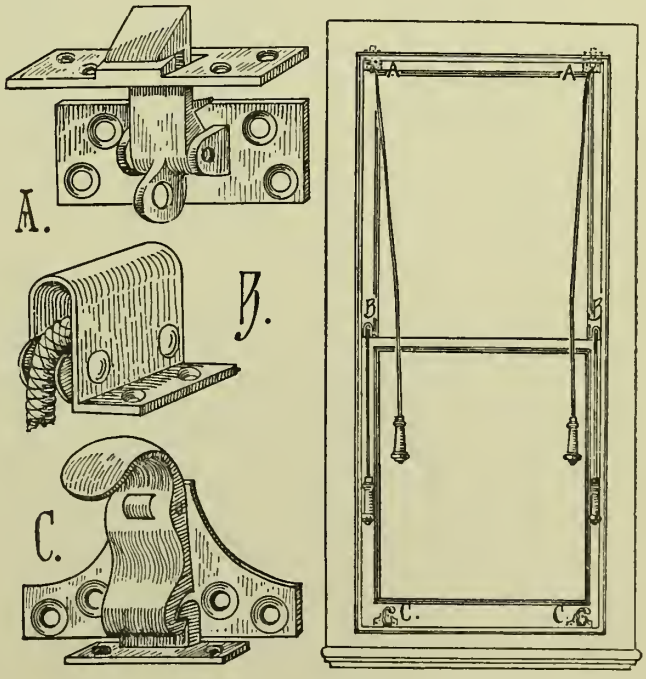


Fig. 200.

and handle, adapted to a set of fanlights opening outwards at bottom. It will be seen on reference to the illustration that on one side of the centre of each fanlight the screw has a right-hand thread, and on the opposite side a left-hand thread, so that when the screw revolves in one direction the hinged arms are drawn together and so open the light. When the screw is revolved in the opposite direction the arms are forced apart and the light closed. Fig. 201, D, shows a screw closes the sashes by means of a hinged crank. The vertical rod may communicate with the crank through any number of bends by means of other cranks and connecting rods as shown.

Fig. 201, F, shows the rod-and-crank system applied to open louvres, and the action will be readily traced from the illustration.

Fig. 201, G, illustrates Robert Adams' patent folding gusset side-draught preventer for fanlights. It is

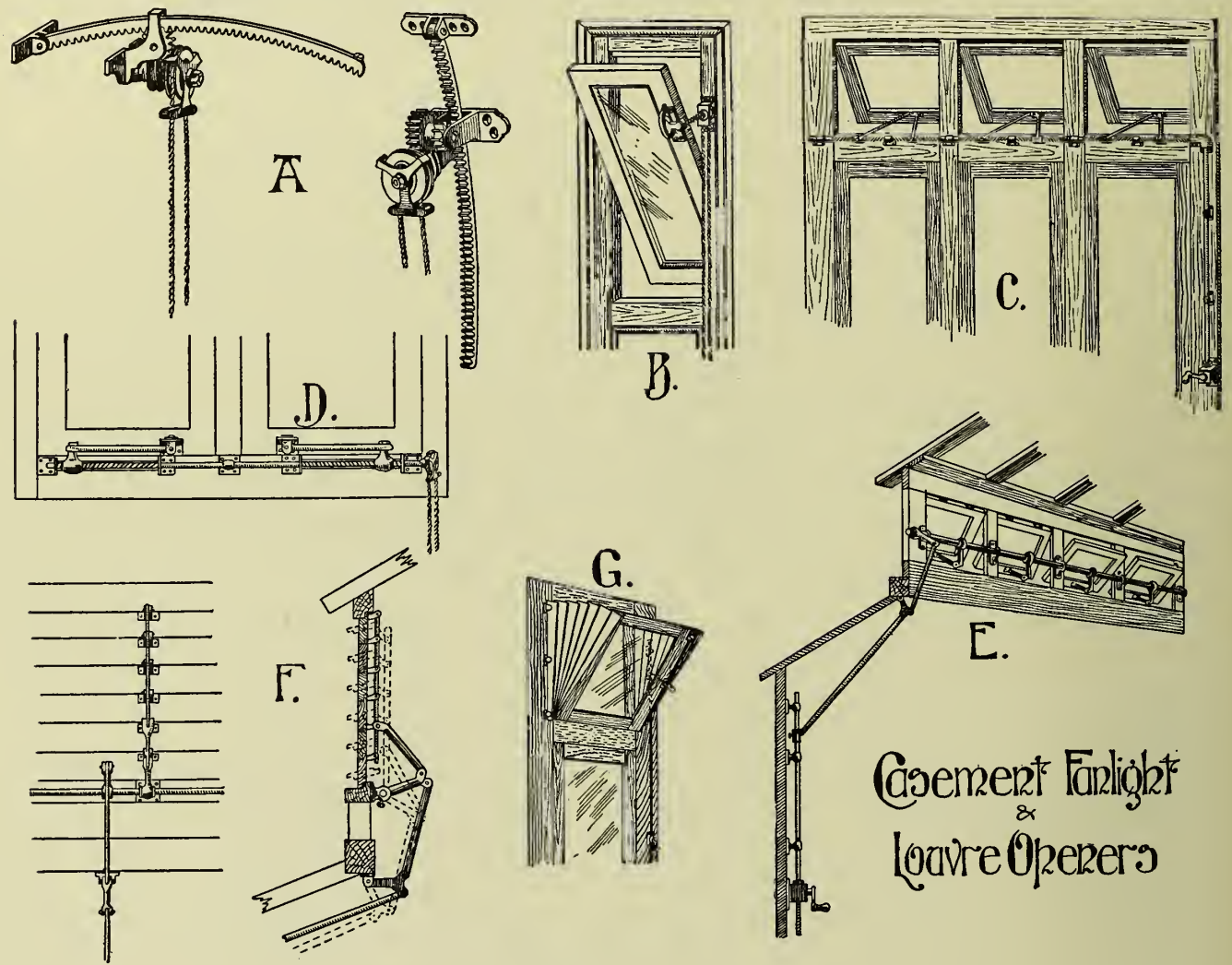


Fig. 201.

opener for casements hinged at side, the action of which will be readily traced from the illustration. In this case the screw is revolved by means of an endless cord, but it can also be made with rod and handle, as is shown at C, which pattern may in turn be made with an endless cord.

Fig. 201, E, illustrates the "Walfruna" lantern light opener for lantern lights, conservatories, etc. In this the horizontal rod is revolved by means of a crank, actuated by a vertical rod which is raised or lowered by a handle. As the horizontal rod turns it opens or composed of metal plates which fold up on the face, or in the joint of the fanlight out of sight, as preferred.

There are a great many other varieties of fanlight and skylight openers on the market, but enough has been said to indicate the general principles and arrangement of some of the simplest and best known. In making a selection, simplicity of construction and good workmanship should be sought. Beyond this, a pattern suitable to its particular use and position should be chosen, each case being decided on its own merits.

PART II

BUILDERS' PLANT AND SCAFFOLDING

CHAPTER I

PLANT REQUIRED FOR SMALL BUILDING WORK (CLASS A)

(*Contributed by* GEORGE HIGHTON)

THE extent and varieties of builders' plant are so very considerable that it is necessary, for easy reference, to formulate the most important of them. In the following chapters it will be seen that the necessary builders' plant is dealt with according to the "grade" of building operations. In this way reference can more readily be made.

The arrangement is made in three classes. In Class A there will be found the necessary plant required to conduct the business of a jobbing builder, or one who chooses to speculate or to build small works under contract. In Class B will be described the extra requirements in builders' plant necessary for use in works of moderate size. In Class C it will be observed that the further plant needed for the very largest works is included.

The materials required for builders' plant, such as planks, boards, shoring timber, quarterings, boarding, etc., depend upon the constant or immediate requirements of the builder, and are not dealt with as "Necessities."

It is, however, desirable that most of the plant referred to as "Necessities" in the following chapters should be at hand or "in stock," although circumstances may arise when the "hiring" of some of them will suffice to meet a temporary necessity.

The importance of sound and durable plant cannot be too strongly urged. Poor, meagre, and defective plant is a bad sign, and very frequently not only prejudices the prospects of a builder in the eyes of the observant architect or surveyor, but leads to accidents which might otherwise have been avoided.

The present chapter deals only with the necessary plant for small or jobbing work included in Class A.

LADDERS.—The ordinary builder's ladder is formed of sides consisting of a straight fir-pole cut in half lengthwise, and connected by heads or rungs usually of oak or ash, preferably the former. Before the fir-pole is cut it is desirable to bore the holes for the rungs, so that they may be parallel throughout. The rungs are fixed 9 inches apart, and usually are from 1 to $1\frac{1}{2}$ inch thick in centre and decrease to $\frac{5}{8}$-inch diameter at the ends. Their ends are painted with red lead before being inserted, and the projections are then cut off flush with the sides. They are usually fastened at each end with wedges (see A, Fig. 202), to fix every fifth or sixth

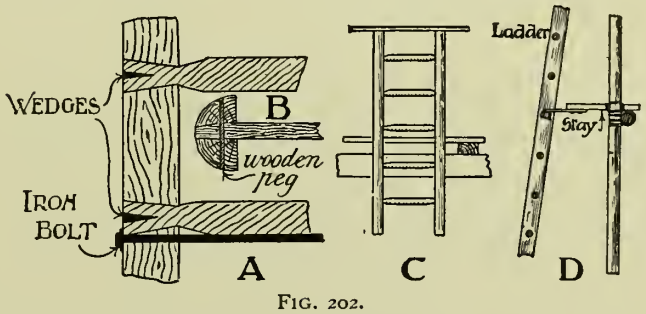


FIG. 202.

rung, or pins (B) $\frac{1}{4}$-inch diameter may be cut through the sides for the same purpose.

The wedging method is to be preferred, as the sides would necessarily be weakened by cross boring.

To prevent the wedges working out an iron rod $\frac{5}{16}$-inch diameter is, in a strong ladder, fixed below every eighth or ninth rung, and bolted on the outside for strength. A rung should not be allowed to be reduced by wear to less than half its original thickness.

In long ladders—say of 100 rungs—the rungs are 9 inches apart at top, and from 12 to 13 inches at the bottom.

For the prevention of accidents in fixing of ladders to platforms of scaffolding their upper ends should

reach to a height of 7 feet above the top platform which they serve. If, however, this cannot possibly be arranged a T-piece should be fixed across the top (see C, Fig. 202) to warn the climber that he cannot obtain any higher hold on the ladder.

It is always well to stay ladders in the centre where their length exceeds 25 feet, to prevent bending or swaying. The stay should consist of a wooden piece with an iron clip. The clipping of the rung as shown

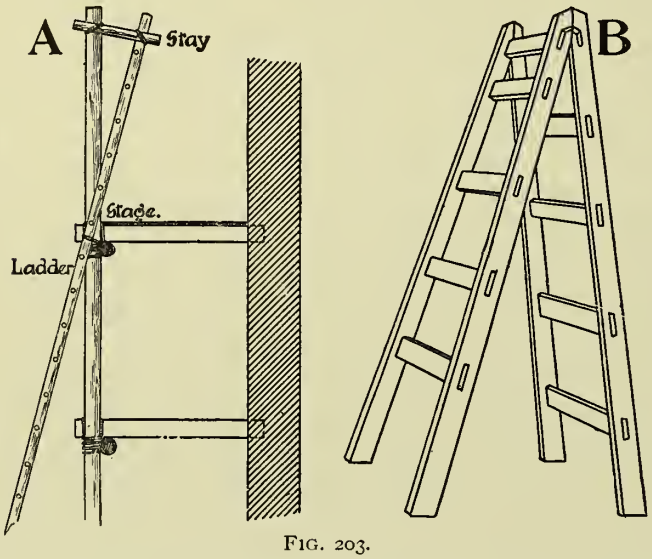


Fig. 203.

at D prevents any interference with the hands and feet of the climber.

When the top of the ladder is considerably above the resting-point a stay, as shown at A, Fig 203, should be secured. Care should always be taken that the foot of a ladder is level, and be firmly secured at the resting-point.

Steps.—Steps have two sides to the necessary height, about 5 inches wide and 1 to 1¼ inch thick, the top and bottom being bevelled so that the steps may stand

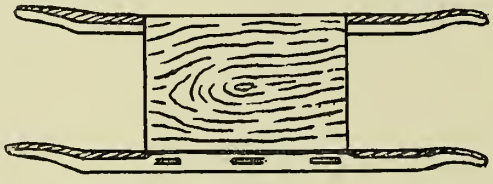


Fig. 204.

firmly and evenly at the required angle. The steps, which are grooved into the sides and project slightly therefrom, and have cut corners at ends, are fixed with screws, and are from 5 to 6 inches wide by 1½ inch thick. They increase in length from top to bottom, thus adding to the strength. The distance between the steps varies from 7 to 9 inches. To prevent the legs opening out unnecessarily wide or collapsing they are connected to the sides of the steps by strong cords knotted at each end through eyelets, in which should be fixed rounded steel rings.

Trestles.—When the whitewasher, plasterer, painter, or mechanic requires to reach a few feet, say 10 to 15 feet, above ground he uses trestles to enable him to erect a platform from which he can work (see B, Fig. 203). They are usually made of yellow deal. The sides, 4½ inches by 1¼ to 1½ inch thick, are bevelled at top and bottom.

The rungs are placed at uneven distances apart, to meet varying requirements as to height of platform. The trestles should be made sufficiently wide to hold three boards at least. The rungs are mortised to the sides. The hinges should be of strong wrought iron, and shaped as shown.

Barrows.—The navvy barrow usually employed in excavating operations, and for the transference of bricks, concrete, etc., is constructed of hard wood with wrought and cast-iron fittings and steel axles. The angles are bound with iron. The bottom should have a steel plate. The wheels may be of iron, or of wood bound with iron. A strong barrow varies in weight from 60 to 75 lbs., and has a capacity of about $\frac{1}{10}$ of a cubic yard.

A barrow of this kind can be slung by passing a hook through the wheel and rings round the handles.

Handbarrows (Fig. 204) are used for carrying light loads and materials which cannot be rolled. These may also be slung.

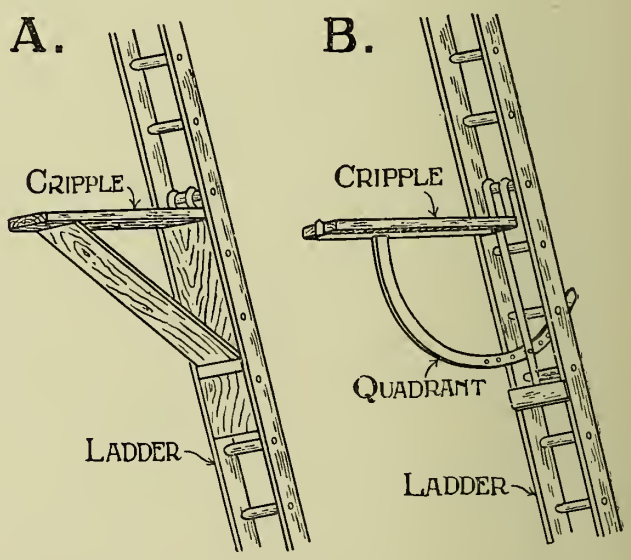


Fig. 205.

Cripples.—The usual and simple form of cripple is shown at A in Fig. 205. This is set at an angle to suit the required slope of a ladder against the wall. In order to keep a level platform it can only be laid at that slope. This inconvenience may, however, be obviated if the cripple is hinged and fitted with a quadrant and pin, as shown at B. By this means the platform can be made level by adjustment independently of the slope of the ladder. The bracket should be at least long enough to carry a platform two boards wide. Cripples may be fixed to either side of the ladder, and

are generally hung on the rungs, but it would be advisable to provide clips to grip the sides of the ladder for increased safety.

Buckets and Baskets.—The strong galvanised iron pail or bucket is much used in small building works, having a flat hoop round the top with bottom and side straps, riveted sides and forged ears. Tipping buckets (No. 1 in Fig. 206) are, however, more used for carrying earth, mortar, concrete, etc. In order that it may tip easily and be upright when empty the hinges are so placed as to be above the centre of gravity of the bucket when empty and below the centre of gravity when full. As the bucket becomes full it tends to make half a revolution, and so get rid of its contents. This is prevented by fixing a catch on hinges so as to grasp the handles at B. Thus the bucket cannot tilt, but should the catch be turned back it makes the half-revolution, and after emptying the contents resumes an upright position of itself. These buckets are of

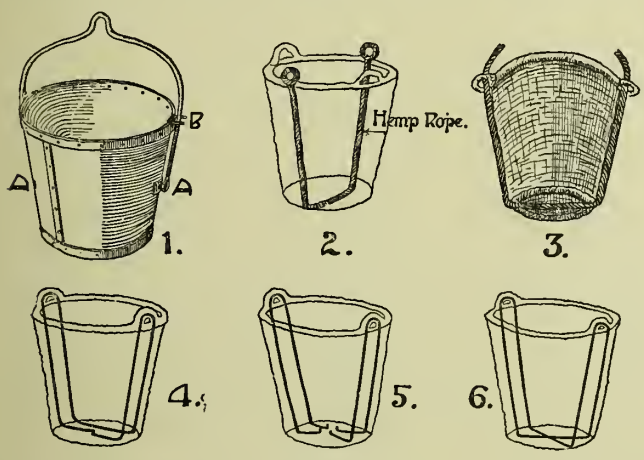


Fig. 206.

steel construction, and may hold, as the case may require, from $\frac{1}{4}$ to 1 yard cube.

Sometimes, however, a steel box having a hinged bottom with catch fixed thereto is used, so that all the material may be deposited at any given place. The catch may be released either from above or below by means of a chain with which it is connected. Thus the bottom of the box recovers its position when reaching the ground for refilling. These boxes are also made of steel, and may be either round or square. Each box is fitted with a bow or bend in the handle to receive hook of chain or lugs for chain slings.

The "Mackerel back," "Short nature," and "Squeaky" are the forms of baskets more commonly used by builders; but, as usually constructed, the handles and bottom do not withstand much wear. Baskets are now constructed on a much improved system and are, therefore, recommended, although their extra weight caused by the introduction of an iron hoop might tell against them. No. 2, Fig. 206, shows a form of bucket used for hoisting purposes. A tarred hemp rope forms part of the basket construction, the handles being for hand use in shouldering. Care should, however, be taken to see that the rope, being in constant use, is sound, so that safety may be ensured. Ordinary baskets may be rendered more safe by passing the slinging rope or chain through the handles and round the bottom, which are made flat by fitting pieces of wood on it. In this way the rope is prevented from slipping (see No. 3). At No. 4 in Fig. 206 will be seen an iron hook bent to the shape required, and the cane plaited round as for the ordinary basket. The handles and bottom cannot, in this construction, give way. The cost of these baskets is necessarily more than that of the ordinary basket, but wear must be taken into consideration. There are various other modes of constructing baskets, shown at Nos. 5 and 6.

In No. 5 the iron is in two parts, which, instead of being a weakness, as it appears to be, renders the basket strong and durable.

In No. 6 the ironwork is shown fixed by means of a wire rope, so that a complete circle may be made. The cost of the spliced rope necessarily makes this basket dearer, but the basket becomes easier to construct and is less weighty than those already referred to.

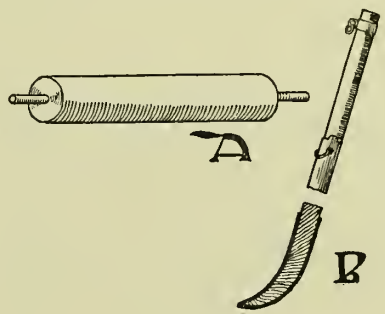


Fig. 207.

Rollers (A, Fig. 207) are used for transferring weighty material along even surfaces.

It is always desirable that pegs should be fixed at each end to form handles, and should project beyond the load to be moved, so that there should be no danger to the workman's hands in adjusting the roller.

Levers (B, Fig. 207) are usually made of ash, and are fitted as shown with iron shoes.

Stone Lewises.—There are two kinds or classes of lewises, the straight-sided and curved. The latter is inferior to the former, as, when it is fixed or fitted into the stone, any sudden twitch or jerk of the supporting chain would tend to cause a fracture at point X (A, Fig. 208).

The hole for receiving the lewis should be cut so that a line down its centre should cross the centre of gravity of the stone. The splayed pieces of the straight-sided lewis (B, Fig. 208) are first fitted, and the centre piece last. A bolt as shown fixes their position, and also that of the hoop or ring by which the contrivance is to be elevated.

The sides or splays should fit accurately, otherwise

they may flush the edge and break out (see C, Fig. 208). The risk of fracture may also occur if the sides do not fit.

Drain Testing and Cleansing Appliances.—"Hydrostatic pressure" is the system of testing drains generally adopted by the sanitary authorities in

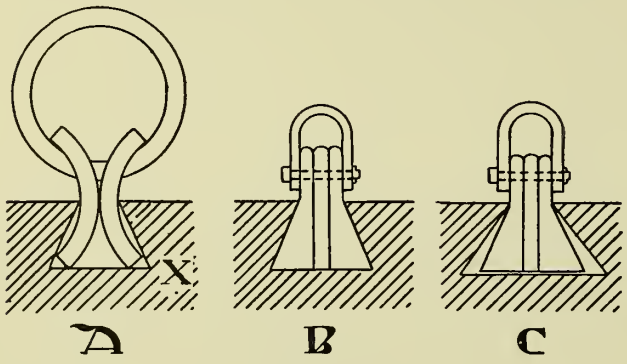


Fig. 208.

London and elsewhere. The drains are usually tested in convenient sections, being filled with water in each section in such a manner as to subject the whole of the pipes and joints to a head or pressure of water not usually more than 5 feet in height.

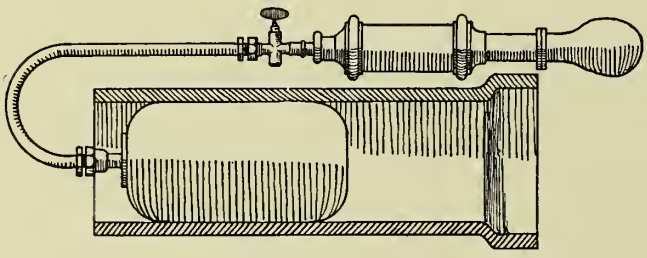


Fig. 209.

Drain Stoppers or Plugs.—When drains are to be tested for leakage it is necessary to stop them at the inspection eye, either with expanding stops or patent bag stoppers. In the latter case an air pump would be required to inflate the bag (see Fig. 209). Expanding

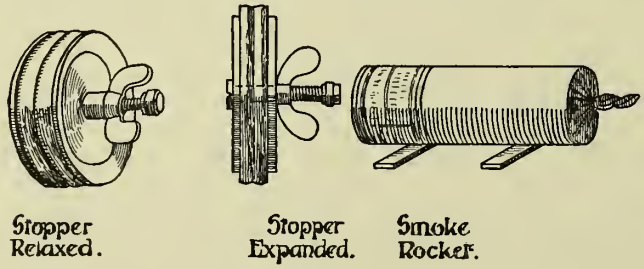


Fig. 210.

stops (Fig. 210) are more generally used, as being more convenient.

Smoke Rockets (Fig. 210) should be kept in store by the builder. They have cross bars attached to them, so that they can be laid in a drain-pipe without actually resting on the pipe itself.

Drain Grenades are made of thin glass hermetically sealed. They are charged with a small quantity of pepperment or other chemical filling. They can be discharged into a drain in various ways.

Malacca cane rods are in constant use for drain cleansing. It is only, however, with a lockfast joint,

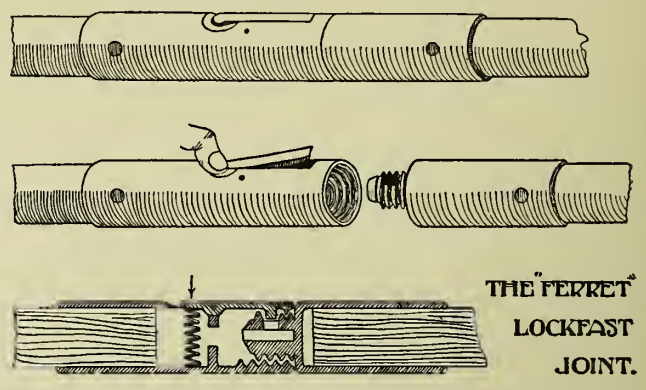


Fig. 211.

such as that shown in Fig. 211, that there can be little, if any, possibility of parts being left in the drain.

The "steel cable drain rods" (Fig. 212) are more pliable and more readily put into work, but while they are easily drawn they cannot be driven.

Lime and Sand Screens and Sieves vary in size according to requirements, but are usually about 6 feet high, with $\frac{1}{4}$, $\frac{3}{8}$, and $\frac{1}{2}$-inch meshes of rectangular shape.

Wheels and Falls.—The gin-wheel (A, Fig. 213) consists of a cast-iron grooved wheel, a light steel frame, a steel shaft on which the wheel can revolve, and a strong steel hook attached to the top of the frame by which the whole can be suspended. The wheel varies from 8 to 20 inches in diameter, about 14 inches being the size most generally used. The better makers put a brass bush in the bore of the wheel, which arrangement adds considerably to the life of the apparatus, the bush being easily renewable when worn and the shaft remaining practically unaffected.

In using the gin wheel a rope having a steel hook firmly attached to one end is passed through the frame and into the groove. The load intended to be raised is connected to the hook, and the free end of the rope or fall is pulled by hand. No mechanical advan-

Fig. 212.

tage is obtained by its use, as is the case when pulley blocks are employed, but its great convenience for lifting light loads makes it one of the indispensable pieces of gear needed by every class of builder.

A manilla rope, 1 inch in diameter and 3 or 4 yards longer than twice the height to which the materials are to be lifted, will be found the most suitable.

The gin wheel is not generally used to handle loads of more than 30 to 40 lbs., but up to this limit it is the best hand-power hoist, as no time is lost in gaining power as with pulley-block or chain-block apparatus. Bricks, mortar, water, etc., can be raised by its means to the level at which the men are working, and in house-breaking rubbish can be conveniently lowered direct into carts for removal.

Pulley Blocks.—When it is necessary to lift large pieces of material, such as steel girders, etc., which are too heavy to be handled with the gin wheel, pulley blocks (B, Fig. 213) are brought into requisition. These consist of a top block having a hook for suspension purposes, wrought-iron or steel plate sides and frame, a ring for securing the end of the rope fall, and one, two, or three, or more pulleys or sheaves, grooved to receive the rope, and running freely on a common pin or shaft. Each pulley, when there are more than one, is separated from those next it by an additional steel plate. There is a bottom block which is substantially the same as the top one, with the exception of the ring, which is not required; and a fall or rope, which is fixed securely to the ring in the top block brought down and passed under the first sheave of the lower one, then up and over the first sheave of the top, and so on until the sheaves are full. The remainder of the rope will then hang free from the last sheave of the upper block.

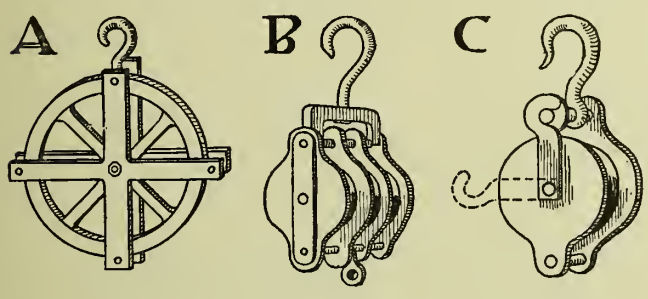


Fig. 213.

This operation (known as reaving the blocks) having been carried out, the blocks are ready for use. As it is not usual to have the ordinary scaffolding of a building of sufficient strength to carry great weights, it is advisable to erect a special derrick or a set of shear legs,—full details of which will be given subsequently under separate headings,—to which the top block can be attached. As is well known, the gain in power by the use of these blocks is directly proportional to the number of sheaves employed, *i.e.* if one man can raise a certain weight with the gin wheel and fall he can raise twice the weight by exerting the same pull on the fall of two single-sheave blocks, although double the time will be consumed in raising the weight to the same height. In some cases the load to be raised may be so great that two or more men are needed to pull on the fall. In these circumstances it is best to bring the fall to the ground, and pass it through a single-sheave block or snatch-block (C, Fig. 213), which should be fixed securely to the foot of the derrick, or some other fixed object, as nearly as possible vertically under the top block. Although securely fixed, the snatch block should be free to turn in any direction, so that the men pulling on the fall, which passes through it, can stand in a convenient position one behind the other. In this way each man is enabled to exert his full strength on the rope, which would be impossible if all were to attempt to pull at once vertically. The snatch block is generally provided with a movable side plate, in order that the fall may be inserted at any point without having to be threaded through its whole length. The blocks most generally in use contain two or three sheaves each, as it has been found that the friction of the rope increases so rapidly with the number of pulleys that more power is lost in friction, when a larger number of sheaves is used, than is gained by the increased power due to them.

Sling Chains.—When a load of any kind has to be raised by means of the gin wheel or blocks and fall it usually has to be attached to the lower hook of the lifting implement by some means other than its own handle, except in the case of a bucket. For this purpose sling chains, made in various lengths and provided with convenient hooks and rings, must be provided. One of the most frequently used sling chains consists of a piece of chain about 5 feet long, the links being made of $\frac{3}{8}$ diameter iron, having a ring in the centre large enough to pass easily over the hook of the blocks or crane, and a small hook at each end. These latter can be passed through the handles of a skip or basket for raising bricks, or taken round almost any piece of stone or timber and hooked back into the centre ring, making a sort of cradle in which it can be safely lifted (A, Fig. 214). Another useful arrangement of the sling chain is that by which an ordinary navvy barrow and its load can be attached to the blocks and lifted, maintaining its horizontal position throughout the entire operation (B, Fig. 214). This is achieved by having three lengths of chain dependent from the centre ring, two of which are the same length (about 4 feet) and the third somewhat shorter (3 feet). The two longer chains each have a ring at their free ends

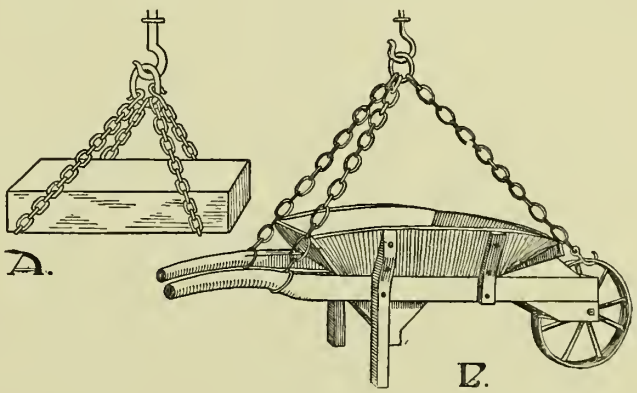


Fig. 214.

large enough to slip easily over the handles of the barrow. The shorter chain is supplied with a small hook, which can be passed under the rim of the wheel.

A good supply of straight pieces of chain provided with a hook at one end and a large ring at the other, of varying length and thickness, will also be found among the necessary plant when the building in hand has reached any considerable height.

Duckruns.—The object of duckruns (Fig. 215) is to prevent damage being done by workmen to slate and tile roofs. They should be very firmly fixed against a solid resistance, or if occasion require by slinging from the ridge.

Fig. 215.

Mortar Boards.—A mortar board is used as a bed or slab upon which mortar can be mixed or placed. It is made of four or five 9-inch boards each 3 or 4 feet long, and framed together on the under side. Its use is to prevent the new mortar coming in contact with the scaffold boards.

Tarpaulins are made of strong canvas, and are thoroughly imbued with tar or an equivalent composition to render them waterproof.

Grindstones are various according to the kinds of edge-tools to be sharpened, and vary in size from 10 by $1\frac{1}{2}$ inches to 70 by 12 inches. They are usually fitted with handle and foot treadle and spindle, and mounted on friction roller.

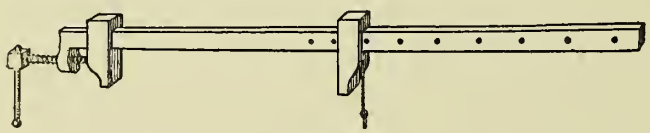


Fig. 216.

The stones may be of "Newcastle" stone or "Free grit." Side plates may be attached.

The Floor Cramp.—Two of these tools at least are necessary for the proper laying of floor-boards. The tool itself (Fig. 216) is a kind of elongated vice, having one jaw roughly adjustable to length by means of a pin passed through any of the holes in the main bar, on which it slides freely, and the other jaw operated by means of a screw and handle as shown. Its use consists in holding the floor-boards firmly edge to edge during the operation of nailing them to the joists, thus avoiding the possibility of any interstices occurring between them.

The floor cramp is generally made throughout of wrought steel.

The Stone Cramp (Fig. 217) is an appliance for lifting light pieces of dressed stone. The cramp, which is made throughout of steel, is first screwed

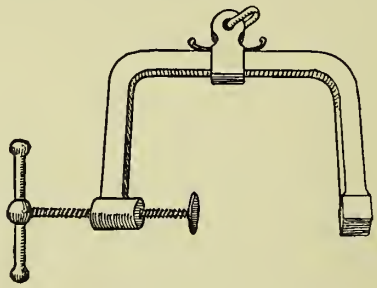


Fig. 217.

tightly down on to the piece of stone to be lifted, care being taken to insert a small flat piece of wood packing on each side, between the steel jaws of the cramp and the face of the stone, to prevent damage to the finished surface. The sliding attachment on the back of the cramp is then moved along until it is in such a position that, when the stone is lifted by the ring let into this attachment, it will hang level. The lower hook of a

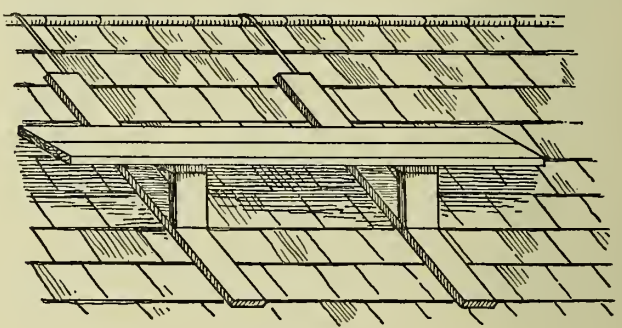


Fig. 218.

pair of blocks can then be placed in the ring and the stone raised easily into position.

Slater's Trusses.—As will be seen from Fig. 218, the slater's truss has to form a platform to enable the slater or tiler to get at his work without kneeling on or damaging that already executed. Trusses are usually slung from the ridge, and are moved to suitable positions as the work requires. Pads or old sacking should be laid under each truss to prevent the possibility of damage to the slating or tiling while the work is in progress.

CHAPTER II

PLANT REQUIRED FOR BUILDING WORK OF MODERATE SIZE (CLASS B)

(*Contributed by* GEORGE HIGHTON)

THE ordinary contractor, engaged in work under Class B, requires to add to the plant of the jobbing builder a considerable amount of lifting tackle and yard machinery, and as his business further develops will also need various machines referred to presently under Class 3.

The DERRICK in its simplest form consists of a single straight pole, placed vertically in a convenient position, generally within the building. The lower end should be either firmly embedded in the ground or securely fixed to some substantial portion of the structure.

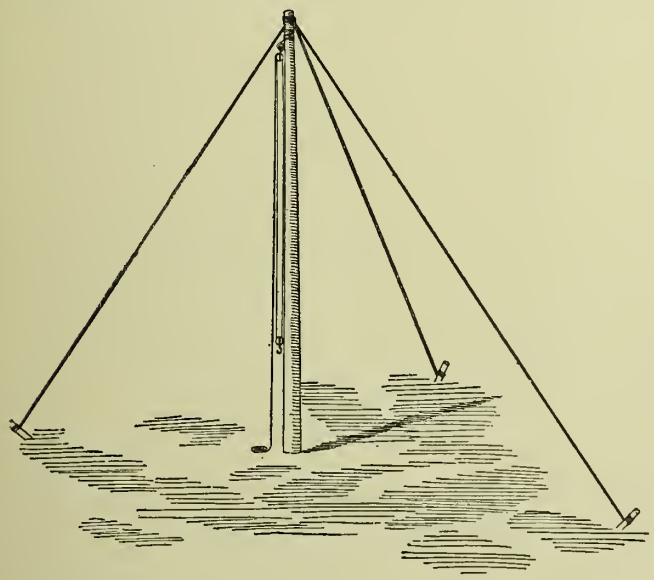


FIG. 219.

The upper end is held in position by three stays or guy-ropes fastened to the top, and carried away as far as possible, and, as nearly as can be arranged, making an angle of 120 degrees with one another (Fig. 219). The addition of a sling chain, bound tightly round the top just below the point where the guy-ropes are secured, and having its terminal ring hanging free to receive the hook of the top block of a set of pulley blocks, completes the derrick.

The pole selected for this implement should be a good sound one, as free as possible from knots and shakes. There is no hard-and-fast rule as to what weight should be placed on any given sized derrick, but loads up to 1 ton can be safely raised 15 to 20 feet on a sound scaffold pole properly guyed. When heavier loads are to be dealt with it is advisable to use a die-square balk of either deal or, better still, pitch-pine; a 12-inch square balk of which latter, 30 feet high, can be safely trusted with a load of 14 or 15 tons. Although it is essential that

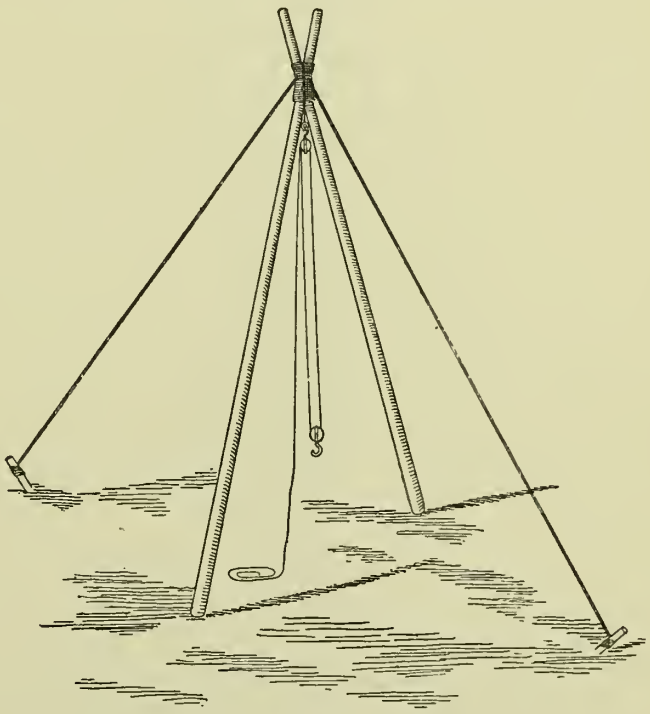


FIG. 220.

the single-pole derrick should be nearly vertical in order to ensure its working under the best possible conditions, it may, in cases where the load is not great, be found convenient to let the top swing over in one or other direction, by means of loosening one of the guy-ropes and at the same time tightening the other two. In this way a load may be raised vertically through a small opening left in an upper floor or stage, and then, by letting the top of the derrick swing over a few feet, landed on the floor or stage itself, or even, if it be, say, a girder or constructional stone, placed in its final position without further handling.

Another form in which the derrick may be constructed consists of two poles, bound together with a stout cord about 18 inches from the top, and inclined towards each other at this point at an angle of about 30 degrees. Two guy-ropes are all that are required (Fig. 220), and by loosening one of these the load may be made to travel a much greater distance than with the single-pole derrick without any risk of buckling the poles. The extra space needed for this arrangement, however, renders it less convenient for use in the interior of buildings in course of erection. It is most useful for raising heavy pieces of material from carts, etc., as the cart containing the load can be drawn directly under the blocks, the load raised and the cart withdrawn empty. The load can then be lowered on to a trolley or rollers and taken within the building to the other lifting apparatus, of whatever kind it may be.

The Bottle-Jack.—It frequently happens during the construction of a building that some heavy piece of material, such as a roof truss, already placed roughly in position, has to be brought to its exact location. In such case the bottle-jack (Fig. 221) will be found of great service. Given a firm base upon which to rest, the bottle-jack, operated by one man, can raise and sustain in position a weight of from 2 to 3 tons. The same force can be applied to any object, either upwards, downwards, or obliquely by its means. It will be seen from the foregoing that its uses are many and varied. Its total lift is, however, necessarily limited to about 1 foot, in order that it may not become too cumbersome to handle. It consists of four parts; the head (A) having its top side notched so as to grip the object to which the force is to be applied, and its lower side turned down to a shoulder and loosely fitted into a corresponding recess in the top of the round head of the screw (B). This is necessary in order that the screw may be turned, by means of the holes bored through the rounded part, while the head (A) remains stationary as regards the turning movement. The screw (B) is generally square threaded as shown, and of mild steel, and is actuated by passing the "tommy"-bar (D), a steel rod about 18 inches long, through the holes before mentioned.

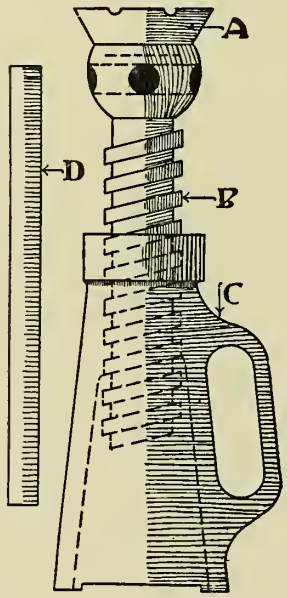


Fig. 221.

The body or "bottle" (C) is of cast iron, and contains a female thread through which the screw (B) passes. A handle is sometimes added, making the jack more portable and easily held in a slanting position when necessary.

Chain Blocks.—When only one heavy piece of material is to be raised to a given position, or other considerations make it not worth while to put crab and pulley blocks into position, chain blocks come into use. There are several forms of this useful device, one of which, known as the differential chain blocks (A, Fig. 222), is perhaps the most generally employed. The upper portion consists of a hook and wrought-iron frame with a shaft supporting a pair of chain wheels, cast in one piece, one being of slightly smaller diameter than the other. The lower part is merely a simple chain wheel and hook—or snatch block. An endless chain, four times as long as the height of lift required, is first pulled round the larger of the two top wheels, passing thence to the snatch-block pulley, thence it returns and winds round the smaller top wheel. As the two top wheels are cast together the result of pulling on the free loop of the chain must be that the

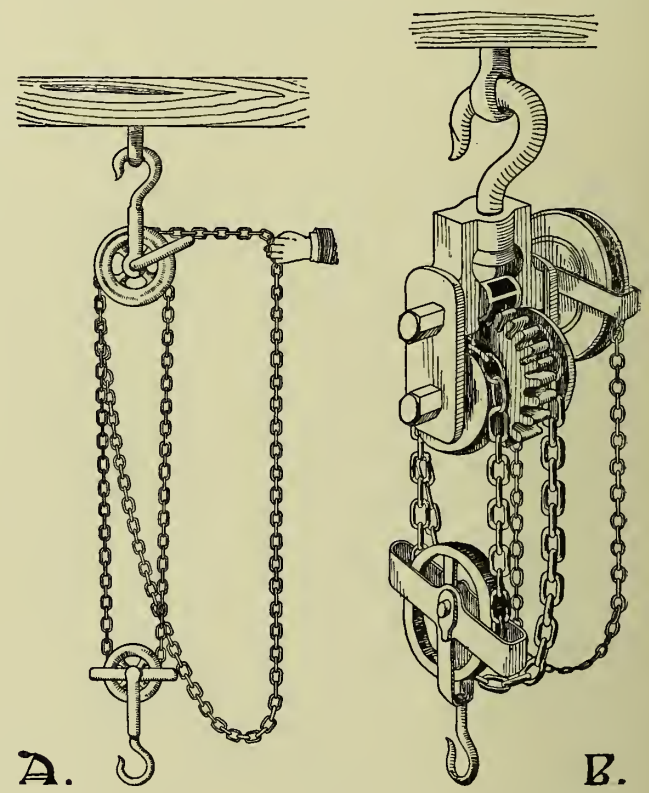


Fig. 222.

snatch block is lifted by a space equal to the difference in their circumference at each revolution of the upper wheel. The chain is prevented from slipping by nibs cast in the sheaves, and the friction due to the different diameters of the two top pulley wheels is equal to more than half the power expended. The load therefore will remain suspended in any position without the use of a brake. When the load has to be lowered the opposite side of the chain must be pulled, about half the effort being required to lower the load as to raise it. The rate of lifting or lowering is, of course, extremely slow. These blocks will deal satisfactorily with loads up to about 3 tons, but for greater weights, say of 10 or 12 tons, some form of geared chain blocks are recommended, such as those shown at B, Fig. 222. These, as will be seen by referring to the figure, have a separate hand-chain and wheel, which actuate a pinion and wheel acting on the lifting sheave. This forms a very strong combination, the gain in lifting power being enormous.

Screw and Hydraulic Jacks.—There are many varieties of screw jacks on the market, all of them

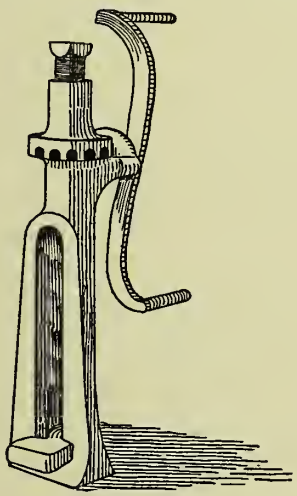


Fig. 223.

being adaptations of the bottle-jack before referred to. The only one we need notice here is the variation known as the windlass jack (Fig. 223). The essential difference between this and the simple bottle-jack is that the nut which the screw works in is turned by the vertical handle, by means of a pair of small toothed wheels geared in the ratio of two complete revolutions of the handle to one of the nut. In this way double the weight can be lifted with the same effort as would be used with a bottle-jack. The windlass jack is also provided with a foot lift for applying force between two objects which are too close together to admit the whole length of the jack. This consists of a projecting "foot" attached to the lower end of the screw, and arranged to work through a slot in the side of the frame. The convenience of this arrangement will be apparent on reference to the illustration.

The hydraulic jack (Fig. 224) is a very great advance in every way on any form of screw-jack in existence. It is a simple means of raising enormous weights with very small effort, with, of course, a proportionate loss in speed. It is invaluable when heavy loads have to be moved or raised by hand labour alone, for by its use large pieces of material or machinery can be placed in their permanent positions without entailing the installation of expensive lifting apparatus, such as cranes, etc. Although the full extent of a single lift with the hydraulic jack is seldom more than 10 inches, yet, by means of properly arranged timber "packing" to support the load at the height attained by one lift, the machine or material being raised can be lifted to any desired height by successive lifting and packing. In

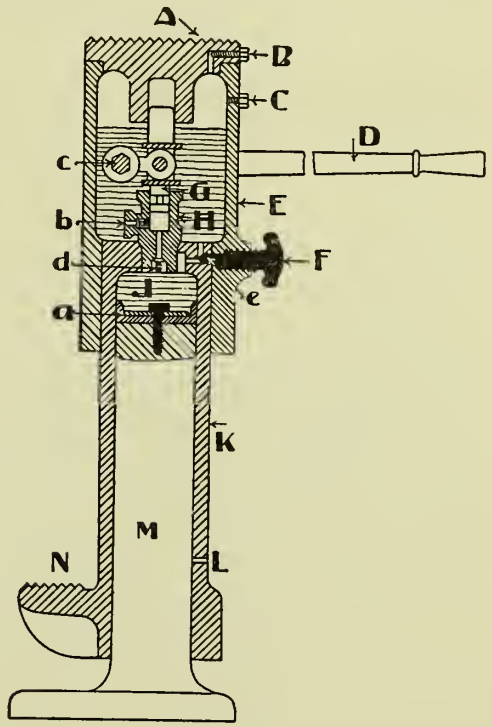


Fig. 224.

Fig. 224 a section of the most usual form is given, which combines in itself two functions, lifting either by the head A or by the foot N, the latter arrangement being intended for use when space is limited.

The construction of the jack is as follows: Inside the upper part a force pump H is fitted, having a plunger G which is actuated by the hand-lever D, the fulcrum of which is at *c*. Below the delivery valve *d* of this pump is the actual ram M of the jack, which slides freely in the cylinder K, the head being made water-tight in the cylinder by means of the cup-leather *a*; the difference in area between the ram G of the force-pump and the ram M of the jack representing the gain in pressure. On raising the lever D the water is drawn from the cistern E through the suction valve *b* into the barrel of the force pump. Pressing the lever downwards closes the valve *b*, and forces the water

through the delivery valve *d* into the space J above the main ram. Continuing this operation, the ram M moves downwards or the cylinder K upwards, until the jack has reached its maximum travel, when the water finds its way out of the blow-hole L, automatically stopping any further relative movement between ram and cylinder.

When about to operate the jack, the cylinder K should be brought down to the bottom of the ram as shown in Fig. 224. The cistern E should then be filled with water through the hole left when the charging screw C has been removed. Care should be taken that clean water only is used in the jack, as any

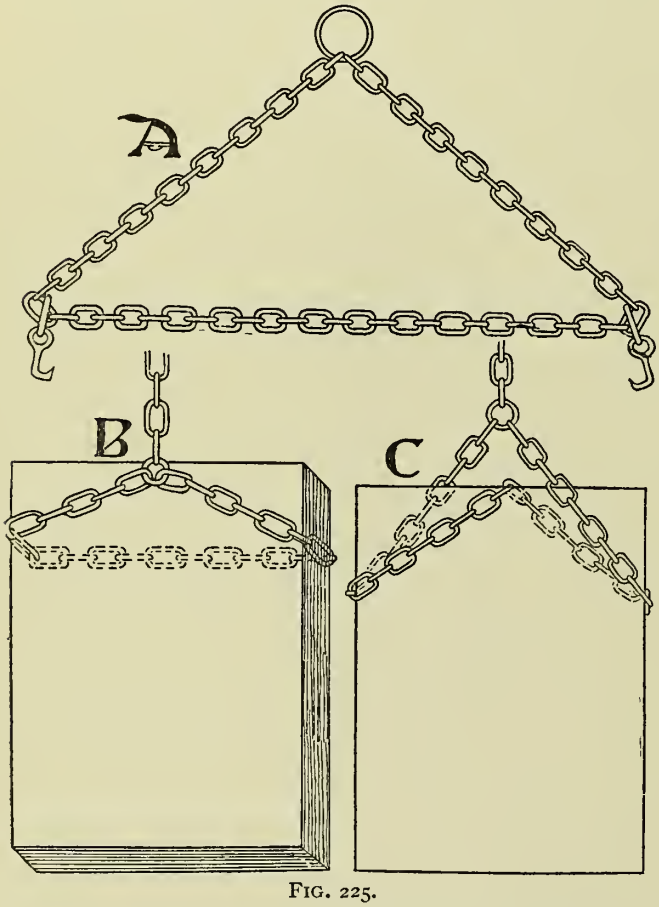


Fig. 225.

grit, sand, etc., contained in the water is liable to both choke the valves of the force pump and cut the cup-leather *a* and cause it to leak. To prevent the water freezing in cold weather it is advisable to fill the cistern with a mixture of water and glycerine in the proportion of three to one. This mixture not only serves to reduce the freezing-point, but also to keep the leather in good condition, and lubricate the gear generally. The cistern having been filled, the lowering screw F is unscrewed and the lever D worked up and down a few times, thus forcing water into the space H and driving the air, present in H previously, through the open valve *e* back into the cistern E, whence it can escape through the air passage B.

This air passage should be left slightly open all the time the jack is being used, to allow air to enter and escape from the cistern. When all the air has been expelled from the space H the screw F is tightened, closing the valve *e*. The jack is now ready for work, and on being placed in position under the load to be raised, and the lever D being worked, the cylinder K will rise on the ram M until the blow-hole L rises above the cup-leather, after which no further motion can be obtained. It is not usual, however, to work the jack to its full limit, as the water under heavy pressure passing out of the hole L is likely to damage the cup-leather of the ram. To lower the jack the screw F is slacked back, a passage being thus provided for the water to flow back from the space J over the ram to the cistern E. If the jack is being lowered under load the speed of lowering can be controlled absolutely by adjusting the screw F and allowing the water to pass as slowly or rapidly as may be required.

With regard to lifting on the foot N, it should be noted that it is not advisable to lift more than about 50 per cent. of the load for which the jack is constructed to carry on the head A, if the distance to be travelled is more than a few inches, it being apparent from the

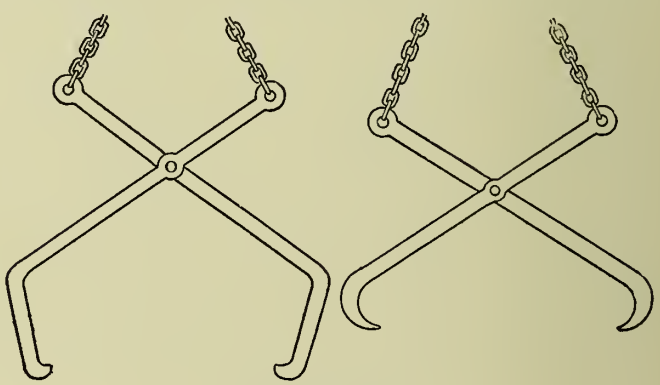


Fig. 226.

position of the foot that the lift is not nearly so direct if it be used.

Clips and Slings.—The clips, as shown at A, Fig. 225, are practically indispensable for lifting thin slabs of stone or ashlar. They are easily adjusted, as the hook rings can be moved along the chain. The width of the stone to be lifted should not exceed half the total length of the chain. Chain slings may also be used for the same purpose, but the thickness of the stone usually determines the mode of lifting.

Jack slinging, as at B, should only be applied to slabs over 6 inches thick, but not of less thickness, otherwise the slab would very probably break.

The figure-eight slinging (C) is, however, the better and more customary method of lifting slabs, as there is less risk of fracture.

Ashlar Shears.—Ashlar shears (Fig. 226) are used in lifting finished dressed work, but care has to be exercised in fixing thin clips in the particular holes

—which have to be made for their reception. These holes must not be below the centre of gravity of the stone, otherwise it would overturn and probably be damaged in its fall. Care should be taken to obviate any dragging of the points upwards or outwards.

Crabs and Winches.—The crab and winch handle in its simplest form is a simple application of the mechanical principle of the wheel and axle, the handle representing the wheel and the crab or drum the axle. It is used for raising small loads of earth, etc., from deep excavations, and consists of two upright posts, a round wooden drum, through the centre of which an iron rod is passed, this being cranked at one end to form the winch handle, and two iron straps bent into shape to form bearings in which the iron rod can be made to revolve.

But few hoisting machines are so simple as to comprise only the winch handle and drum. The power

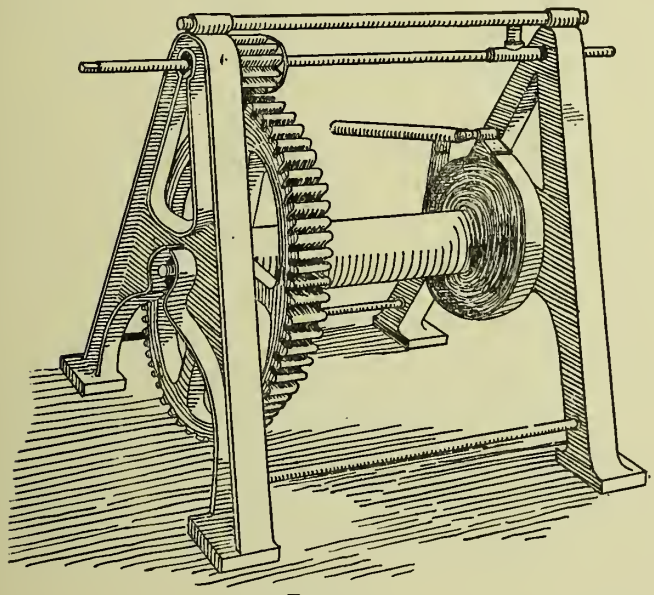


Fig. 227.

gained would be totally insufficient for lifting heavy loads. In the single-purchase crab (Fig. 227) the first advance on this device occurs. The winch handle is not put on the same shaft as the drum, but on another lying parallel to it, and the two shafts are geared together by means of toothed wheels, a small one actuated by the winch handle directly actuating a large one on the same shaft as the drum.

The mechanical gain is proportional to the difference in diameter of the large and small toothed wheels, the small one being known as the "pinion" and the large one as the "wheel," on the mechanical principle of the wheel and pinion. A further development of the same appliance occurs in the double-purchase crab (Fig. 228). In this case the power is applied by the winch-handle to the drum through a series of either two or three gear wheels; *i.e.* the winch handle can be applied to either the first or second wheel of the series, the power being proportionally increased in each case.

A brake should be fitted to all crabs to facilitate lowering operations, and is usually in the form shown in the figures, namely, a flexible steel band passed round the periphery of a flat drum which is of larger diameter than the drum of the crab, but cast in one piece with it. This flat steel band is so arranged that, by depressing the hand-lever attached, it can be tightened on the drum, and by the friction so caused arrest its movement gradually or instantly, according to the amount of pressure exerted.

In use the crab is generally bolted down to a rough timber framework which extends some distance behind it. The framework is then loaded with bricks or cast-iron fire-bars, or some such weighty material, in order to give the crab the necessary stability. The rope (wire or manilla) from the pulley blocks is then passed two or three times round the drum, and on the winch being turned is either allowed to coil up on the drum

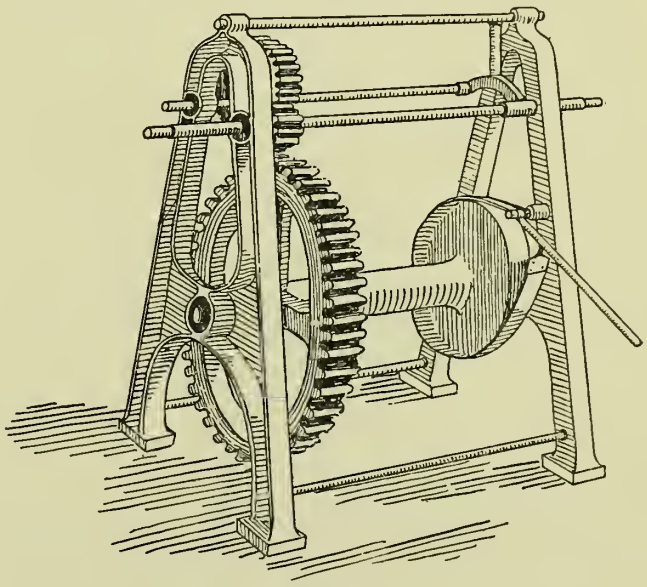


Fig. 228.

or the free end past the drum is held by hand and coiled on the ground as it comes in. These crabs are made to lift (with the aid of three sheave pulley blocks) weights from 2 to 20 tons, the load up to which they may be safely used being marked on the side frame by the manufacturer.

Wire Ropes and Tightening Screws.—For use as guys for derricks when heavy loads are to be handled, the wire rope has many points to recommend it. It is also advisable to use this form of rope for blocks and falls when the size of a hemp or manilla rope becomes excessive. Its advantages consist of its lightness and portability combined with great tensile strength. For use with pulley blocks it is necessary to have the rope as flexible as possible, and this is attained by specifying the number of strands, or separate wires, of which the rope is to consist when ordering from the manufacturer; the greater the number and the smaller the diameter of the strands in any given rope, the more flexible it will

be. The ropes most commonly used have six strands, each containing twelve wires, and a hemp strand at the centre (Fig. 229), each wire being about $\frac{1}{50}$ of an inch in diameter. The number of strands, and of wires in each strand, is, however, arbitrary, and ropes of 8 strands each of 10 wires, of 10 strands each of 9 wires, and various other proportions are adopted.

A comparison between the safe working strength of white manilla rope and one of steel wire shows the great advantage to be obtained by the use of the latter, the greatest permissible load for a manilla rope being 10,600 lbs. per square inch of section, whereas a steel wire may be loaded up to 55,000 lbs. per square inch with perfect safety. The sheaves of the blocks, however, should be of as large a diameter as possible when wire ropes are used, as the constant bending and unbending of the wires composing them is the greatest source of deterioration. This fact is well illustrated by results obtained from careful experiments made during the construction of the Forth Bridge, where a great deal of this kind of lifting tackle was in use. It was here found that when the *diameter* of the sheave was equal to six times the *circumference* of the rope the rope

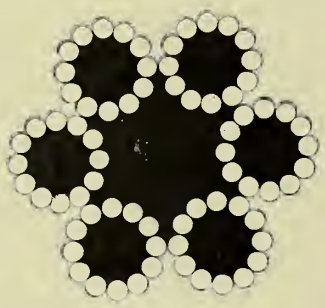


Fig. 229.

could be bent over the sheave 5000 times under load before failure commenced, whereas when the diameter of the sheave was 8 times the circumference of the rope the bending could take place 10,000 times before any sign of defect was noticed.

The wire rope is never used when hand labour only is available for lifting, as its comparatively small size and smooth surface does not give sufficient "grip." It is essential that the free end from the top, or from the snatch block (as the case may be), should be passed three or four times round the barrel of a crab or winch, thus obtaining a firm hold on the rope and applying the necessary power with the greatest economy of time and labour.

When the wire rope is used as a stay or guy-rope the conditions, of course, are quite different to those obtaining with pulley blocks. In the latter case its advantage consists in being much less liable to stretch under load. In making use of it in this way two of the three guy-ropes are made fast to their anchor posts in the ordinary manner, and the third is connected to its post by an arrangement for taking up the slack mechanically, as this is impossible by hand for reasons before stated. The device is called a tightening-screw, and consists of a wrought-iron frame of rectangular form having a right-hand female screw at one end and a left-hand one at the other. Into these two hooked bars, having right and left-hand male threads respectively, are inserted, and it follows that, when the two hooks are held still and the frame revolved on its own axis, the two hooks are drawn nearer together. By attaching one hook to the anchor post and passing the other through a loop in the end of the guy-rope, already pulled as tight as possible by hand, it is only necessary to turn the centre frame of the tightening screw to obtain the required tension in the guy-rope.

The Hand Pump (Fig. 230) is a simple lift or "bucket" pump having a galvanised sheet-steel barrel,

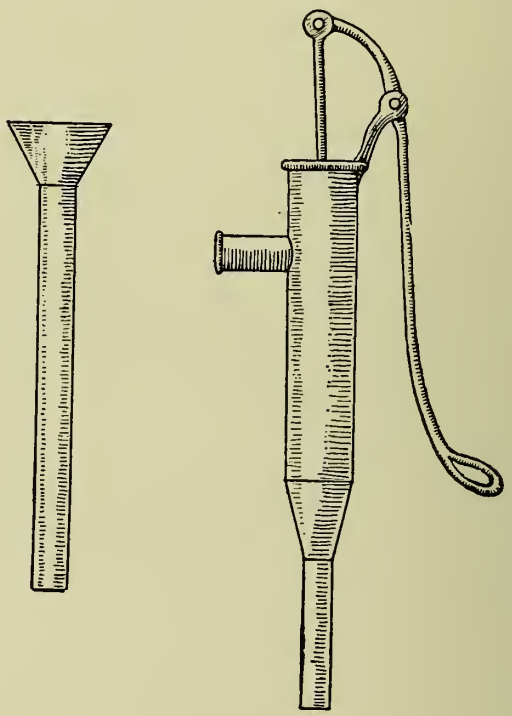


Fig. 230.

wrought-iron fittings and handle, brass and leather valves, and a leather bucket. It is most generally used for clearing excavations from accumulated water before starting building operations, and is often left in position during the whole job in case a storm should flood the cellars before they can be covered in. If the water has to be raised to a greater height than the length of the pump—usually about 7 feet from the spout downwards—an extra piece of galvanised steel tube, funnel shaped at the top, is added to the lower end of the pump, the joint being made air-tight by filling in the funnel with moist clay or "pug" after the pump has been inserted. These extra pieces are, as a rule, about 8 feet long, and two of them may be added to the pump if required. It is not advisable to attempt to raise water from a greater depth than 15 feet with

this type of pump, but rather to bring into use one or other of those described later.

For lifts of 6 to 10 feet, however, this type will be found to be the cheapest and at the same time the most efficient appliance suited to the work.

Machinery in Yard.

A builder of the class with which we are now dealing will require a certain amount of fixed machinery at his works or yard in order to be able to deal with such joinery and stonework as cannot conveniently be purchased ready finished for use. Some of these machines may be hand driven, such as mortising, boring, and tenoning machines, band saws, etc. For others, such as the circular saw, it is absolutely essential to have a prime mover of some kind installed. When possible an electric motor, with current supplied from the local electric light and power station, is no doubt the best form of prime mover, but, failing this, there remains a wide choice between gas engines, oil or petrol engines, and all the various makes of steam engines and boilers. Of all these the gas engine has probably the most points to recommend it. Once started—a matter of a very few minutes with the modern gas engine having magneto-ignition—it requires little or no attention during the whole of the day's run, and when finished with at night the mere act of turning off the gas tap ensures the stoppage of all expense connected with its working until such time as it is required again. In small power plants the convenience of using the ordinary lighting gas of the town outweighs the saving made by installing a suction gas plant and manufacturing, by an extremely simple process, one's own gas. When the plant, however, is large enough to require an attendant more or less constantly the saving effected by the use of the suction gas plant renders it practically a necessity,—the cost of gas of a quality sufficiently good to be used for power purposes manufactured by this process being, generally speaking, about 75 per cent. lower than that of town gas. An engine of from 15 to 20 actual horse-power would be all that would be required by such a firm as we are dealing with, it being an ascertained fact that it is never necessary

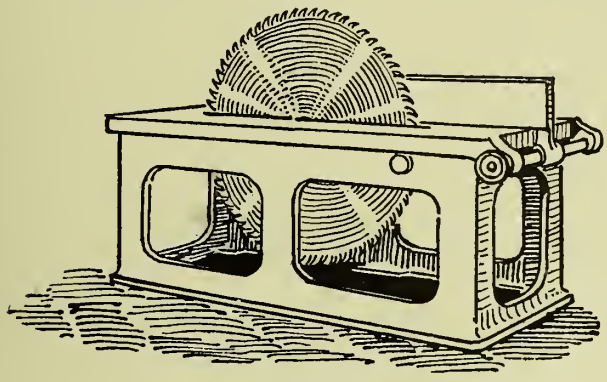


Fig. 231.

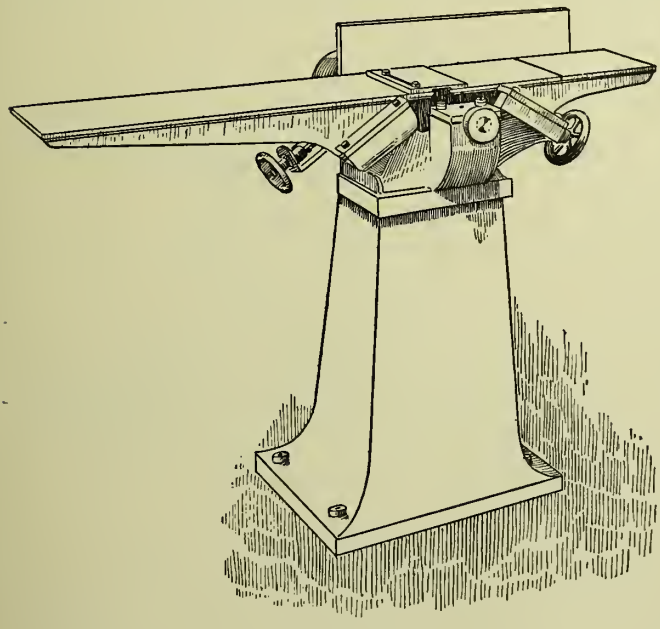


Fig. 232.

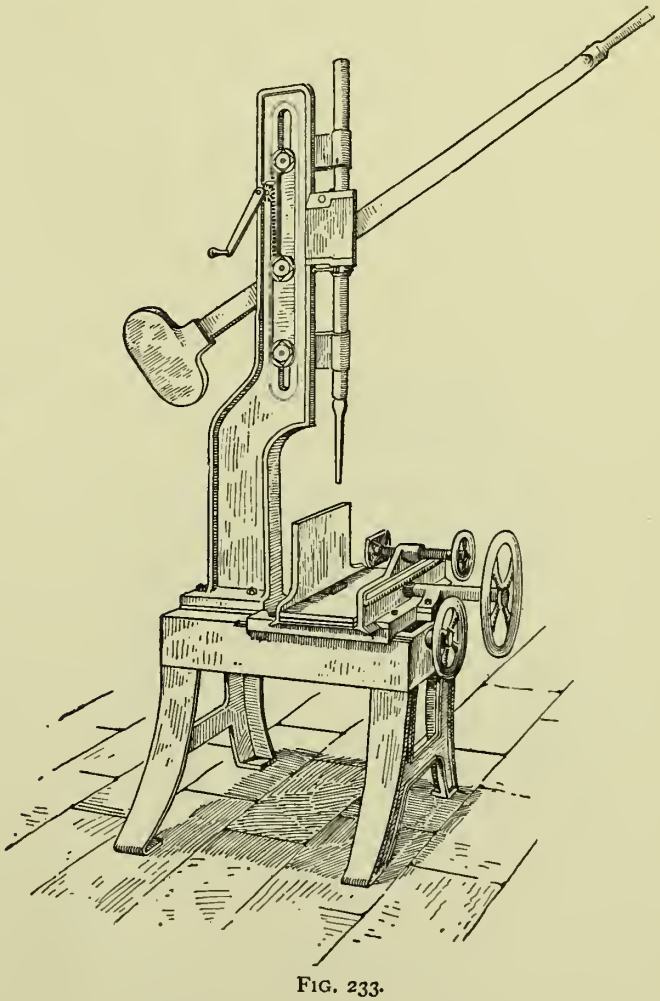


Fig. 233.

to run all the machines in any such works simultaneously.

The Circular Saw Bench (Fig. 231) consists of a strong cast-iron frame or table, the top of which is planed true, and has a narrow slot near its centre through which the upper part of the saw runs, the saw itself being carried on a spindle of steel fitted to run in bearings just below the surface of the table. This spindle is caused to revolve rapidly (from 800 to 1200 times per minute) by means of pulleys keyed

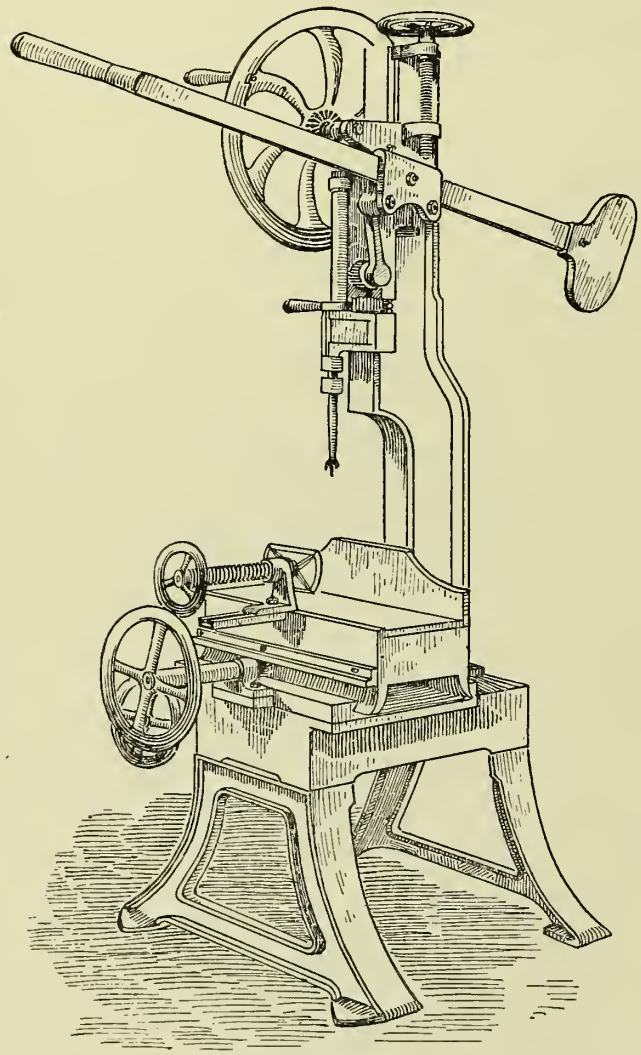


Fig. 234.

on to it and a belt running round them. In order to ensure a uniform thickness of the wood being sawn, a guide plate, adjustable by means of a hand wheel and screw, is fitted at one side of the table, and by its means the thickness of the plank or board to be cut can be gauged with the greatest accuracy. The power taken by these saw-benches is somewhat high, and the waste of wood much greater than caused by hand sawing, but the great saving in time and labour far outweighs these considerations. There are many different makes of saw bench, some of them having a great variety of adjustments, such as rocking tables, automatic feeding apparatus, etc. The one illustrated is, however, quite sufficient for all ordinary work of moderate dimensions.

The *Planing Machine* (Fig. 232) is a power-driven apparatus for taking timber out of "wind" or twist, surfacing straight or taper, levelling, chamfering, squaring up, making glue joints, etc. It consists of a table, planed true, supported by a pillar, both of cast iron, the table having a spindle running beneath a central cross slit, the spindle carrying a series of cutters or knives revolving at a rate of about 800 revolutions per minute. The spindle is adjustable vertically as regards the surface of the table, and can be regulated to take a greater or less cut off the surface of the timber passed over it. The machine is also provided with an adjustable guide or fence at one side of the table

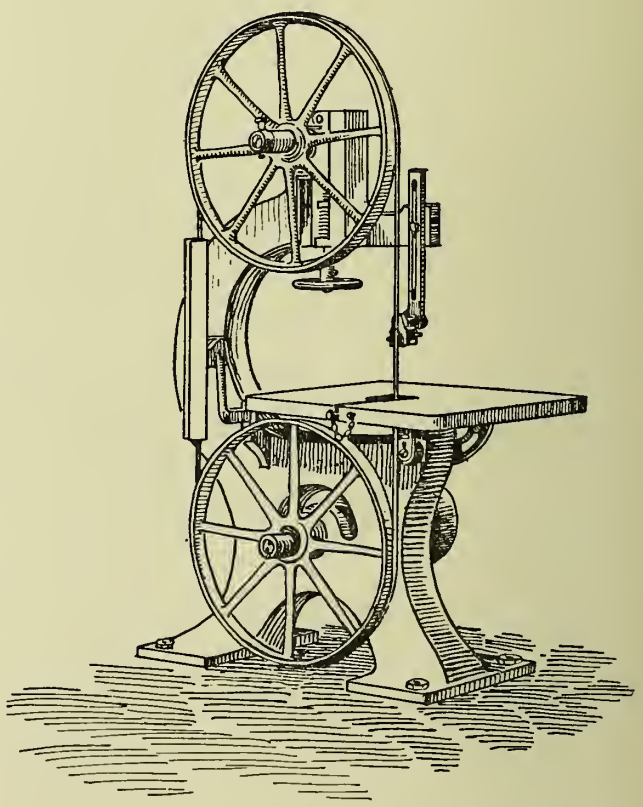


Fig. 235.

The *Mortising Machine* (Fig. 233) is a hand-power device for forming the mortise of the much used mortise and tenon joint in joinery. It consists of a cast-iron frame having a movable table, actuated by a hand wheel and an upright cast-iron pillar, securely bolted to the lower frame, carrying the spindle, slide bracket, and lever, by means of which the chisel is caused to rise and fall. The material to be mortised is held firmly on the sliding table by a vice, and the chisel is worked up and down vertically by means of the lever with the right hand, while the work is

traversed slowly along by means of the hand wheel with the left. At the end of the mortise the chisel is turned completely round by reversing the spindle, and the operation repeated in the opposite direction, backwards and forwards until the mortise is completed.

A useful combination of this machine with a boring machine is shown in Fig. 234, in which the spindle has both reciprocating and revolving motions.

The *Band Saw* (Fig. 235), as its name implies, is a saw in the form of an endless band, which is caused to run at a high speed over rubber-covered wheels placed vertically one above the other on a suitable cast-iron frame. The saw passes through a slot in a cast-iron table midway between the wheels, and on this table the material to be worked is placed. With this machine flat timber or plank can be cut to almost any curved or tapered shape. It is also very useful as a cross-cut saw. The top wheel is made adjustable so that the saw can be tightened when necessary—the power for driving being applied to the lower wheel by means of a shaft and pulleys.

The cast-iron table is arranged to cant to almost any angle, this adding considerably to its usefulness in various kinds of work.

CHAPTER III

PLANT REQUIRED FOR BUILDING WORK OF THE LARGEST SIZE (CLASS C)

(*Contributed by* GEORGE HIGHTON)

A MORTAR-MILL is indispensable on work where large quantities of mortar are required. The type illustrated (Fig. 236) is one of the most convenient forms, being combined on one portable frame with its own engine and boiler. The lime, sand, etc., is introduced into the pan, together with the proper proportion of water, and the engine is then started, causing the pan to revolve, and also the rollers, since they bear on the bottom of the pan. This combined action of pan and rollers mixes the ingredients intimately together, scrapers being arranged so as to continuously return the mixture under the rollers.

When combined sufficiently the mortar can be with-

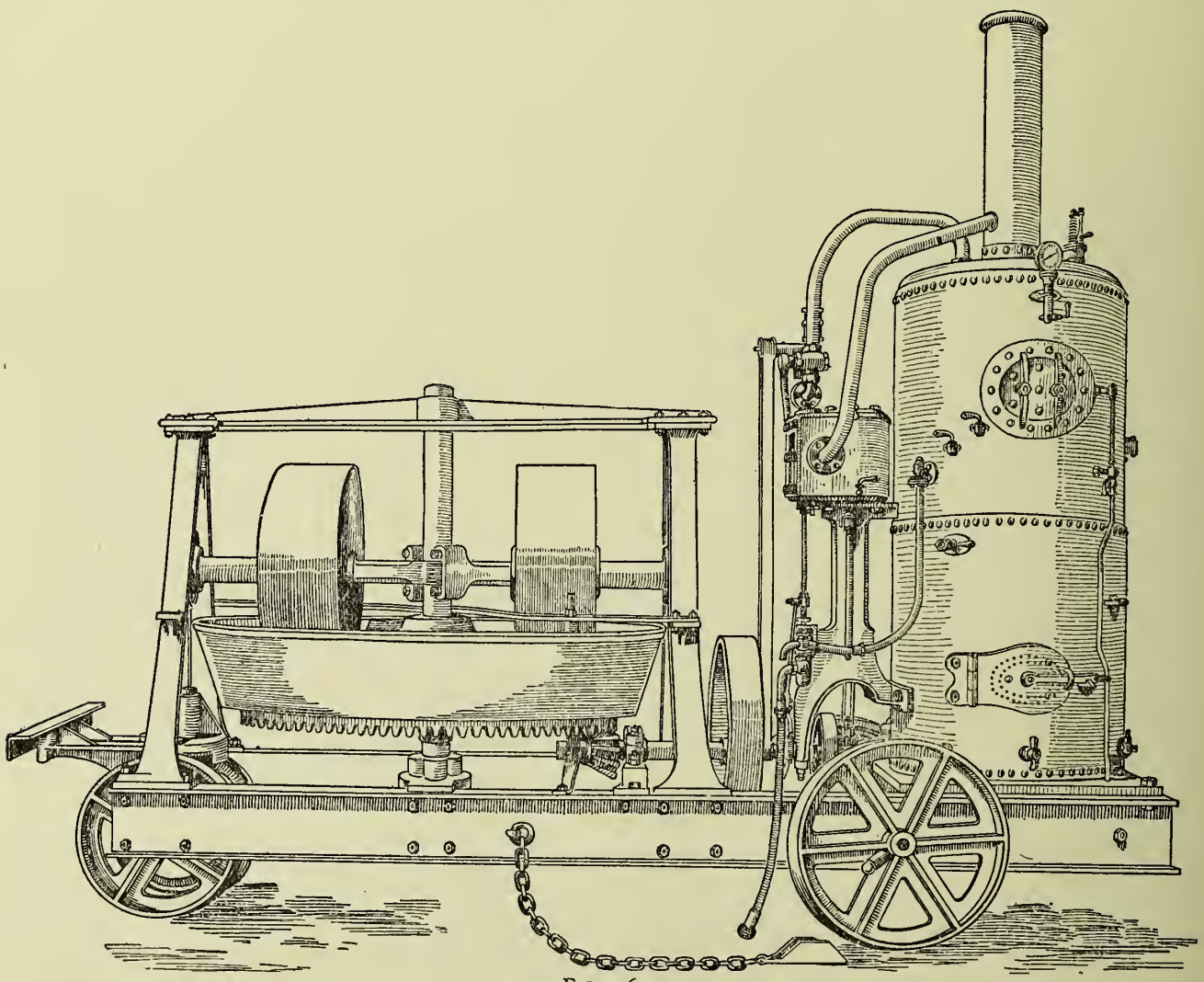


FIG. 236.

drawn either by catching it in a shovel while the mill is revolving or by stopping the mill and shovelling it out into barrows, trucks, or skips as the case may be.

The engine in the type illustrated is arranged to be quite independent of the mortar-mill framing, thus

doing away with any chance of being thrown out of line by strains or shocks in the mill itself. It can be disconnected from the mortar mill by means of a clutch and lever. The speed is controlled by a high-speed governor. The bearing brasses and wearing surfaces generally should be provided with complete means of lubrication. The boilers, constructed of steel, are supplied with heavy pattern steam fittings, including a spring-loaded safety valve.

The mortar pan is of the under-driven type, with renewable false bottom, heavy rollers, and adjustable toe piece to centre spindle. The frame consists of two deep steel joists connected by strong cross girders. The road wheels are of cast iron. Both front and back wheels are provided with buffers, so as to reduce vibration when travelling over rough roads.

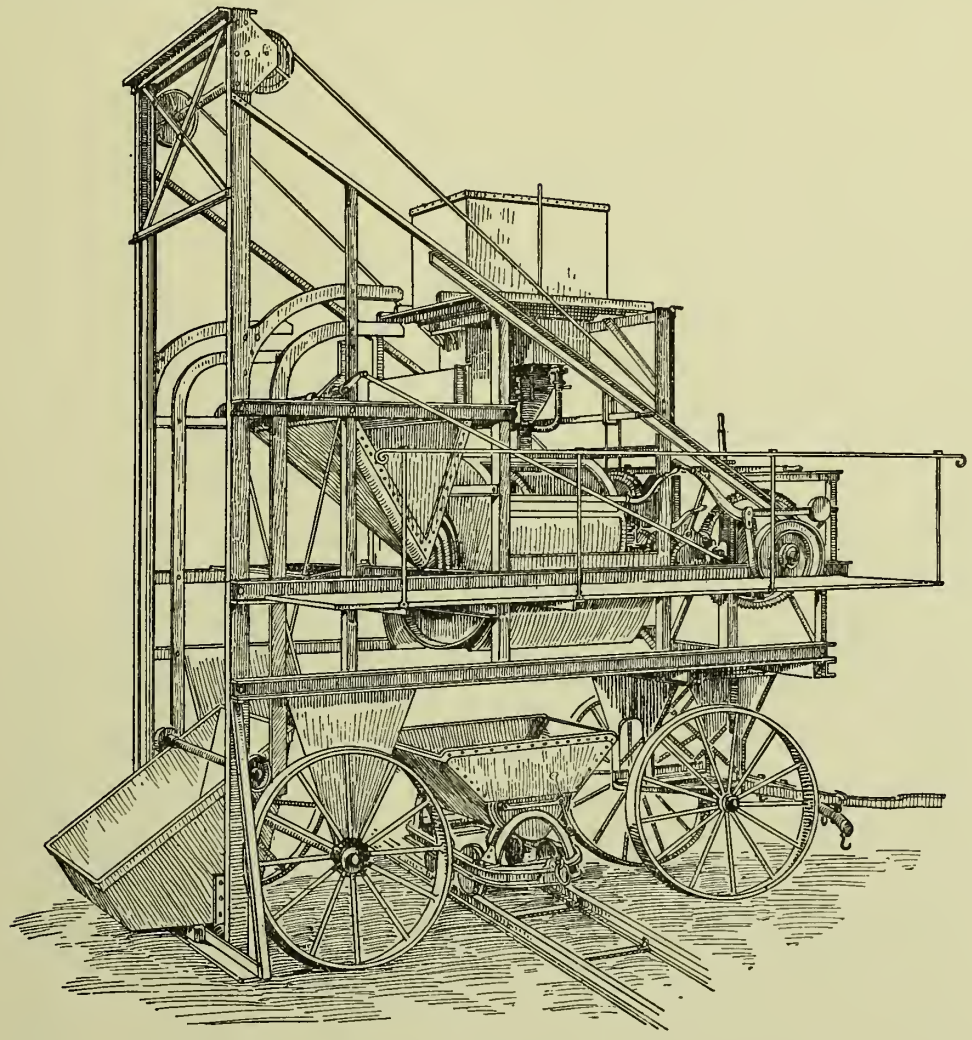


Fig. 237.

Concrete Mixers, of which Koppel's, illustrated in Fig. 237, may be considered typical, are usually supplied with an elevator, and the elevator box is sufficiently large for one charge, and acts as a measuring gauge. The sand, stone, or ballast is either tipped direct from side tipping waggons, or is shovelled into the box. The quantity of cement desired is then added, and the attendant, by operating a lever, causes the elevator box to ascend and discharge its contents into the feed hopper. The aggregate is admitted from the feed hopper into the drum, of which sectional drawings are given in Fig. 238, immediately the attendant allows the mixed concrete from the previous charge to fall out, so that no interruption occurs in work. The feed hopper is provided with a patent shaker, which facilitates the entrance of the material into the drum and prevents the opening from choking up. The drum is fast on the driving shaft, and rotates with it. Four mixing paddles are attached to the shaft inside the drum; they are set at a slight angle to the axis of the shaft, and serve, when the drum is rotating, to constantly and vigorously disturb the material, with the result that a perfectly mixed concrete is obtained. In the mixing process the larger pebbles operate somewhat like the balls in a ball mill, inasmuch as they rub the cement and sand

intimately together and prevent the moist material adhering to the drum. A scraper is also provided to keep the interior sides and ends of the drum clean.

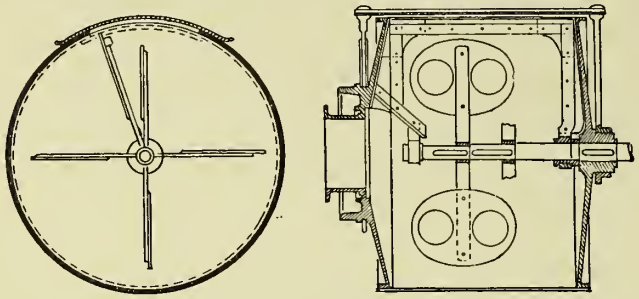


Fig. 238.

During the mixing process the next charge is elevated ready to be fed into the hopper.

For regulating the water supply the machine is provided with two automatically filled water-gauge tanks fixed underneath the main water tank. They are connected with the main water tank, with each other, and with the water pipe leading to the drum by a 4-way cock. Both valves are controlled by a common draw rod, and an arrangement is provided whereby the exact quantity of water required for each charge can be easily regulated. The drum opening is fitted with an automatic sliding cover, which is operated by a lever. The discharge is effected without any interruption of the rotation of the drum, the sliding cover being released and arrested for one revolution, thus allowing the discharge of the contents. On the completion of the revolution the sliding cover automatically closes the opening ready for the next charge.

A Sand and Gravel Washer and Screener, also made by Koppel, is shown in Fig. 239, the feed being continuous. By turning off the water supply it can be used, when required, as a screener only. It is suitable for builders and contractors for screening and washing sand and gravel for mortar and concrete ; and can be obtained either "Portable" or "Stationary," and for either steam or hand power. The hand machine works very easily, indeed, one man being readily able to turn the handle against two men shovelling in dirty material.

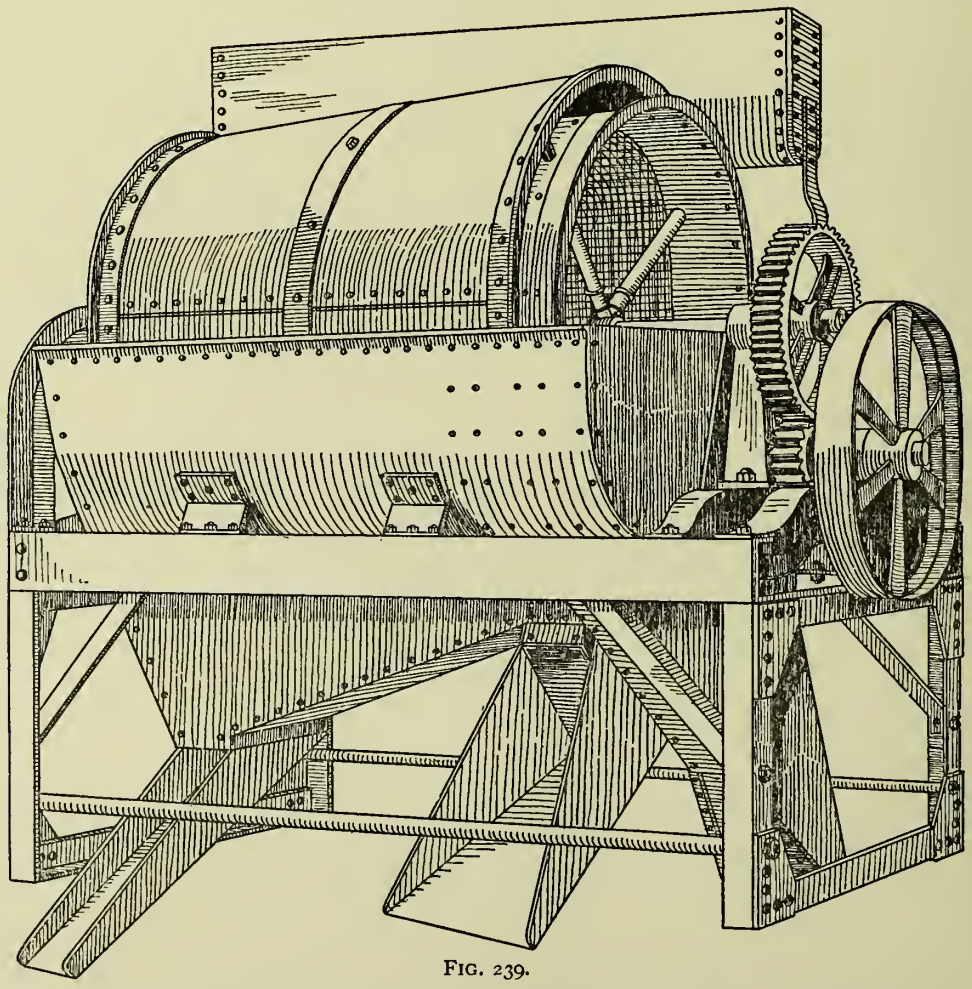


Fig. 239.

The size of meshes can be made as desired. The outputs and water consumption vary greatly, according

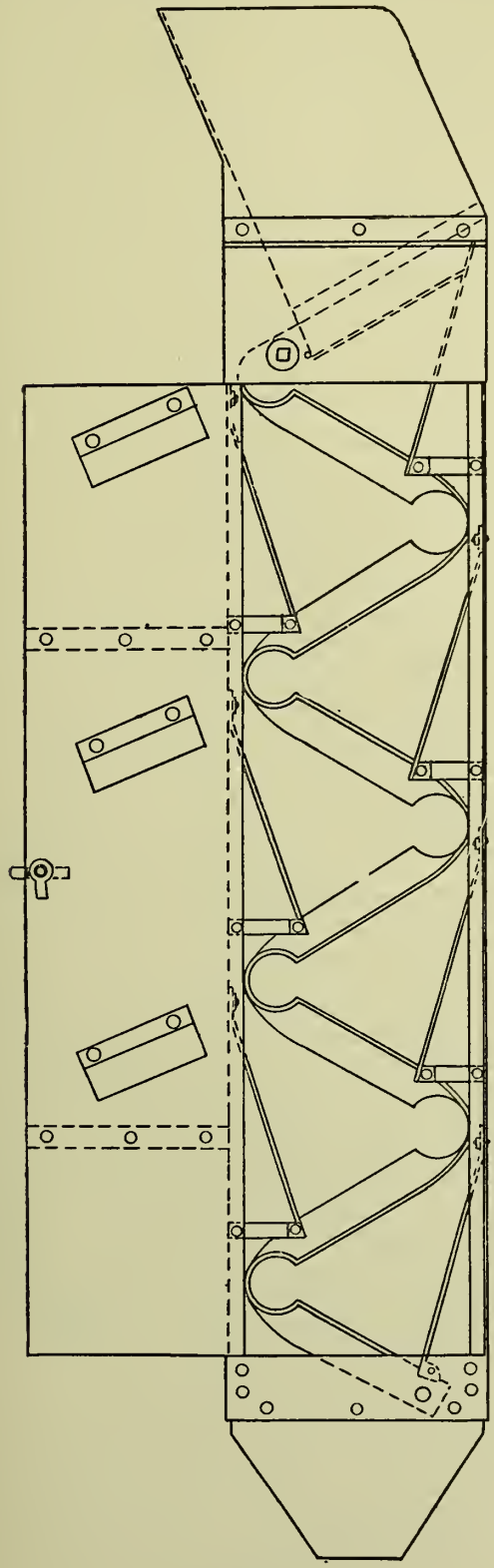


Fig. 240.

to the size of meshes adopted and the proportion of dirt contained in the material. As will be seen, it consists of two concentric drums, of which the inner, formed of a mesh, revolves within the outer one.

A Portable Gravity Mixer, such as Owen's (Fig. 240), is specially suitable for foundation and trench work, and for mixing concrete in small quantities.

It consists of a steel shoot 7 feet long, containing three sinuous mild steel angle bars extending in one length from the top to the bottom. They are fixed rigidly at the top and are held loosely at the bottom by a $\frac{1}{2}$-inch pin. In addition there are eight large and six small steel baffle-plates fixed to the sides of the shoot. An inspection door to facilitate cleaning is provided at one side. The water supply pipe is fixed behind the lower edge of the top baffle-plate, and is perforated both back and front with a row of $\frac{1}{8}$-inch holes, and provided with a brass regulation cock. By this arrangement the whole of the baffle-plates and sinuous bars receive a spray of water, and thus provide a wet surface throughout

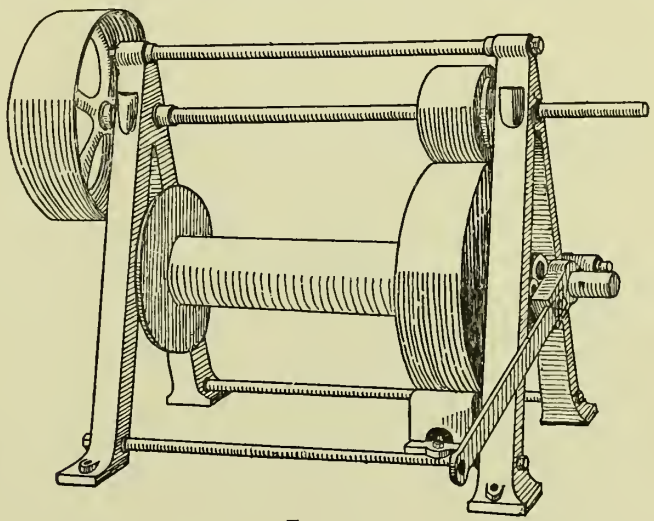


Fig. 241.

the mixer to meet the falling aggregate. The ballast or stone and cement are spread evenly over a platform, which is placed immediately in front of the mouth of the mixer. The material is then shovelled into the mixer, and the sinuous bars and baffle-plates arrest its progress and deflect it in various directions, causing a constant splitting up of the mixture into two columns, which meet and separate alternately, while falling the full length of the mixer. The clearance between the sinuous bars can be increased or reduced by fitting bars of a suitable width for each requirement according to the size of the aggregate to be mixed.

The Friction Hoist (Fig. 241) will be seen to be in its main features identical with the single-purchase crab—a pair of friction drums taking the place of the toothed wheels, and a pulley that of the winch handle. It is only used for the rapid hoisting of comparatively light loads, but for this purpose it is very efficient. The power is applied by means of a belt driven by the mortar-mill engine or other source of power.

The machine is of such design and construction that, while amply strong for its work, it is at the same time light enough to be conveniently handled.

The raising and lowering of the load are under the control of one man, who may be stationed at any convenient place, the only communication between him and the machine being by means of a cord attached to the lever, and passed over suitable pulleys. In its

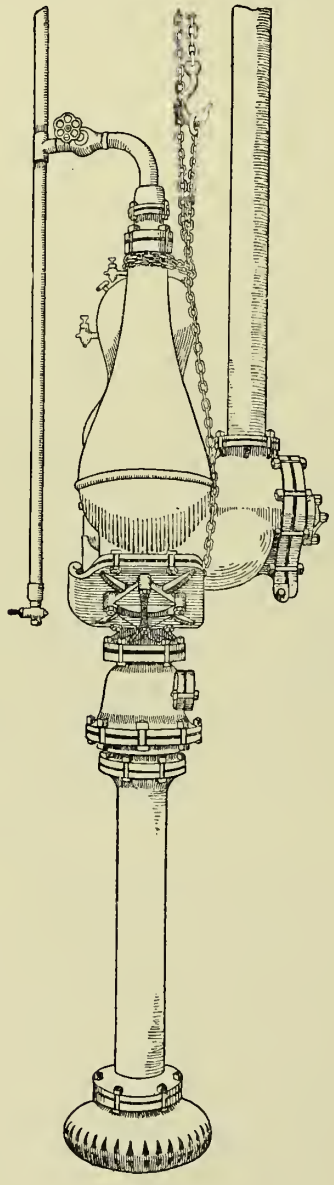


Fig. 242.

normal position the hoist drum is firmly pressed on the brake block. By pulling the cord the drum is raised from the brake, allowing the chain to run out and lowering the load. Pulling still more raises the drum higher, pressing it against the friction pulley, which is revolving the whole time and thus hoists the load.

Pulsometer Pumps are extremely handy for contractor's use, for keeping excavations clear of water, and similar work (see Fig. 242).

Their chief advantages are as follow:—

1. They require no fixing, but will work well hung on a chain.

2. They have no pistons, buckets, or other frictional wearing parts; consequently a little sand or grit in the water, which would soon cut an ordinary pump to pieces, has no effect upon a pulsometer.

3. No exhaust pipe is used; the exhaust steam is condensed inside the pump. This saves complication and extra cost, and does not heat the air in a pit or sump so much as when an exhaust as well as a steam pipe is employed.

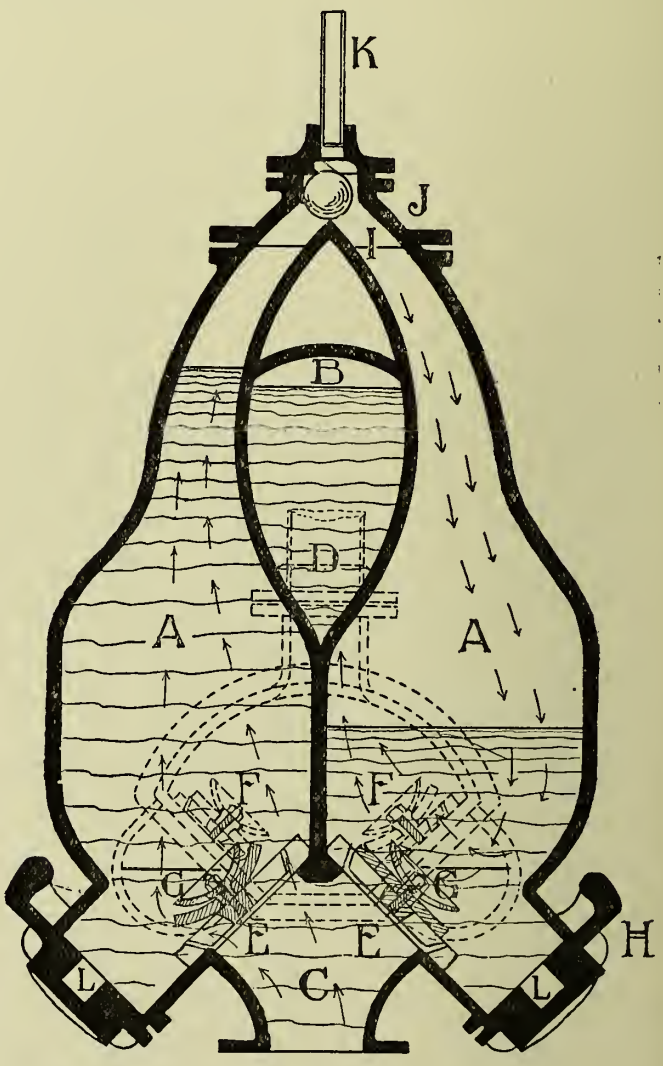


Fig. 243.

The following description will make clear the action of the pump, which it is as well to understand before putting it to work. Once started it will work without attention as long as the steam supply—which may be obtained from any boiler in use on the work—is kept up. A flexible steam hose may be used in cases where it is necessary to lower the pump as the water level in the sump or foundation sinks.

The pulsometer consists, as may be seen by the

section given in Fig. 243, of a single casting called the body, which is composed of two chambers (AA) joined side by side, with tapering necks bent towards each other, and surmounted by another casting called the neck (J) accurately fitted and bolted to it, in which the two passages terminate in a common steam chamber, wherein the ball valve (I) is fitted so as to be capable of oscillation between seats formed in the junction. Downwards the chambers (AA) are connected with the suction passage (C), wherein the inlet or suction valves (EE) are arranged. A discharge chamber, common to both chambers, and leading to the discharge pipe, is also provided, and this also contains one or two valves (FF), according to the purpose to be fulfilled by the pump. The air chamber (B) communicates with the suction. The suction and discharge chambers are closed by hinged covers (HH) accurately fitted to the outlets by planed joints, and readily removed when access to the valves is required; in the larger sizes hand holes (LL) are provided in these covers. GG are guards which control the amount of opening of the valves (EE). Small air cocks are screwed into the cylinders and air chamber.

The pump being filled with water, either by pouring water through the plug hole in the chamber, or by drawing the charge, as can readily be done by attention to the printed directions, is ready for work. Steam being admitted through the steam pipe (K) (by opening the stop valve to a small extent) passes down that side of the steam neck which is left open to it by the position of the steam ball, and presses upon the small surface of water in the chamber which is exposed to it, depressing it without any agitation, and consequently with but very slight condensation, and driving it through the discharge opening and valve into the rising main.

The moment that the level of the water is as low as the horizontal orifice which leads to the discharge the steam blows through with a certain amount of violence, and, being brought into intimate contact with the water in the pipes leading to the discharge chamber, an instantaneous condensation takes place, and a vacuum is in consequence so rapidly formed in the just emptied chamber that the steam ball is pulled over into the seat opposite to that which it had occupied during the emptying of the chamber, closing its upper orifice and preventing the further admission of steam, allowing the vacuum to be completed. Water rushes in immediately through the suction pipe, lifting the inlet valve (E), and rapidly fills the chamber (A) again. Matters are now in exactly the same state in the second chamber as they were in the first chamber when our description commenced, and the same results ensue. The change is so rapid that, even without an air vessel on the delivery, but little pause is visible in the flow of water, and the stream is, under favourable circumstances, very nearly continuous. The air cocks are introduced to prevent the too rapid filling of the chambers on low lifts and for other purposes, and a very little practice will enable any unskilled workman

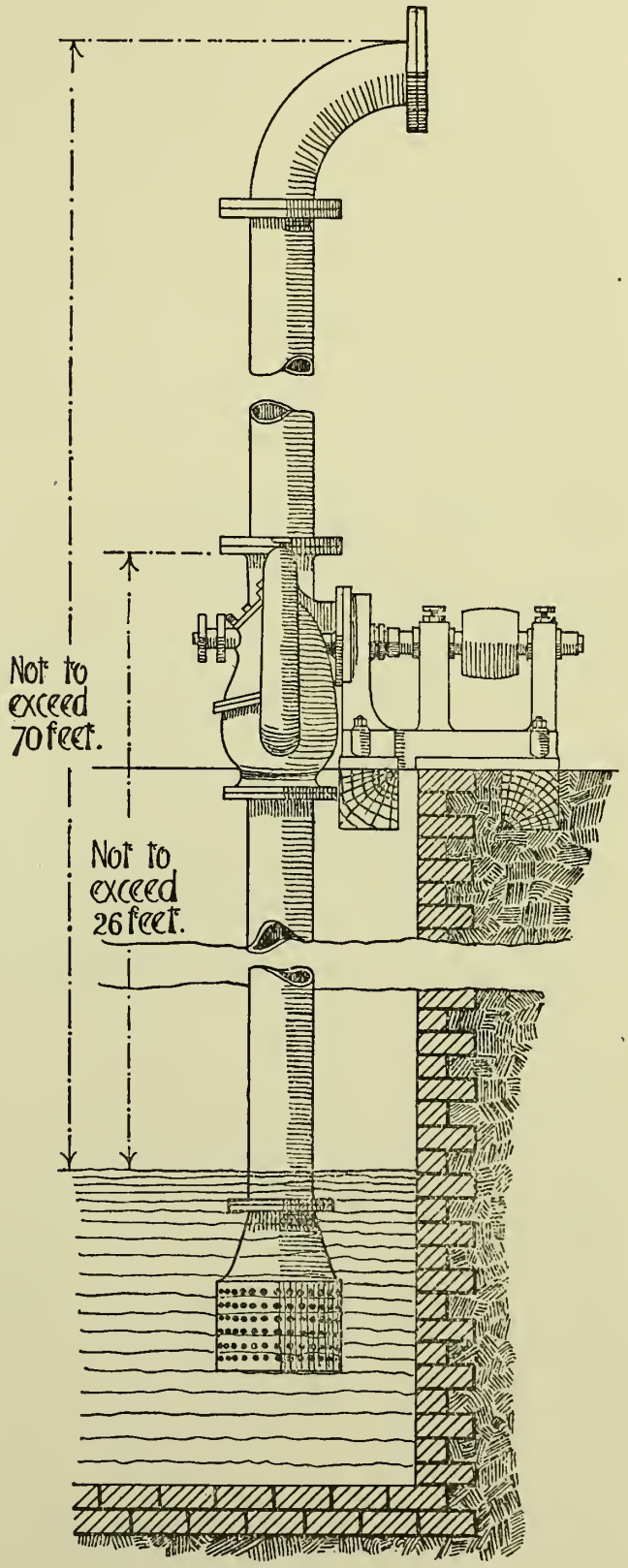


Fig. 244.

or boy so to set them by the small nut that the best effect may be produced. The action of the steam ball is certain, and no matter how long the pump may have been standing it will start as soon as dry steam is admitted.

The steam ball, if once made true, wears itself and its seats true, as it turns in its bed at every stroke, so that no part of its surface falls twice in succession upon the seat. If properly constructed, a spherical steam valve working in a true seat has proved itself the best of all the forms of distributing valve which have been invented.

Centrifugal Pumps, as shown in Fig. 244, will generally be found the most suitable appliance for raising large quantities of water to moderate heights. The foundations necessary for fixing them are not expensive, and owing to the simplicity of their construction it is possible to use them satisfactorily in cases where the water is charged with mud or sediment, which would practically prevent the use of pumps of the ordinary type.

The length of suction, measuring from top of pump down to water level, should not exceed 26 feet. If the water is to be raised a greater height than this the extra piping should be fitted above the pump as delivery and not below it as suction. This means that if the well or sump-hole is more than from 22 to 24 feet deep down to the water level the pump must be fixed on a stage down the well and not on the ground level. If there is any difficulty in taking the driving belt from engine to pump under these circumstances a small intermediate or counter shaft and pulleys can be fixed above the pump to drive the latter by means of a second belt.

A Steam Winch, the principal use of which consists in raising considerable loads rapidly, is really, as can be seen from the illustration (Fig. 245), a double-purchase crab driven by two small steam engines built on its own framework. These engines are reversible, but the load can be lowered on the brake without running the engines round, this being accomplished by throwing the toothed wheels out of gear and so setting the engines free. The crank pins of the engines are set at an angle of 90 degrees from each other in order to avoid the possibility of a "dead centre," the result being that the winch can always be started by turning on the steam, no matter what position the crank pins may be in.

Portable Engines.—When the building under construction is of considerable size a portable engine becomes one of the first necessities, and sometimes two or more of these engines can be employed to advantage on different processes about the work. The concrete mixer, the friction hoist, the mortar mill, the stone or brick crusher, and various other machines in use on the site all require power to drive them, and this can be supplied by the portable engine more economically, perhaps, than from any other source. Where electric current can be obtained from supply company's mains close by, the convenience attendant upon its use for power purposes may often induce a contractor to install electric motors in preference. A point to be borne in mind, however, in this connection is that, in London, many of the electric supply companies do not use the same voltage or pressure in their mains. Thus an electric motor which is suitable for use in one part of London may, and probably will, be quite useless in another district. No restriction of

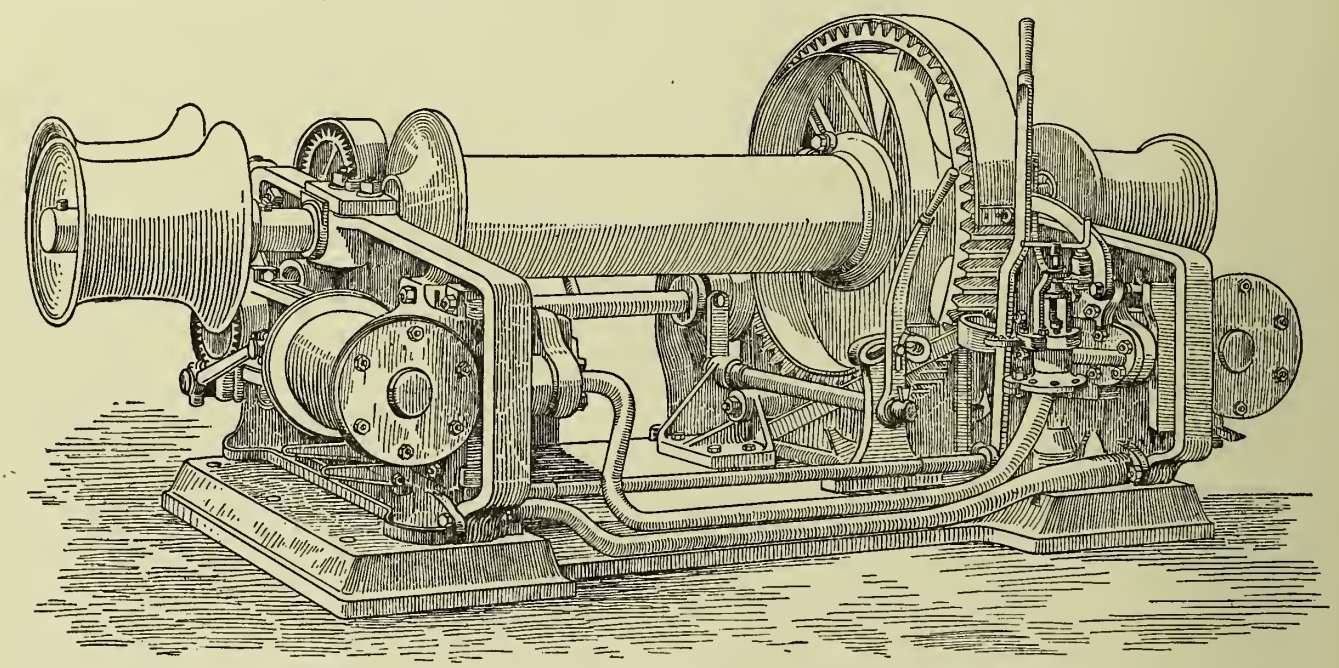


Fig. 245.

this kind applies to the portable engine, as coal, oil, and water can always be obtained locally with ease.

The engine itself consists of an ordinary horizontal steam engine, with either one or two high-pressure cylinders, or in the larger sizes with a high and low-pressure cylinder, this latter type being known as a compound engine. The cylinder or cylinders are firmly bolted to the top of the fire-box of the locomotive boiler which supplies the steam, and the crank shaft is carried either by cast-iron horns containing the bearings, or preferably by boiler-plate brackets riveted on to the fore-end of the boiler barrel, on which brackets the ordinary bearings or plummer blocks are bolted. In the latter arrangement it is desirable that the plummer-blocks should be connected to the cylinder casting by a strong wrought-iron stay, which will take all the thrust and pull of the reciprocating motion of the engine, thus avoiding all unnecessary strain on the plates or shell of the boiler. A fly-wheel, which also serves as a driving pulley, is mounted on one end of the crank shaft, and it should always be stipulated in ordering one of these engines that the crank shaft shall be sufficiently long to take a fly-wheel or pulley on either or both ends. The exhaust or waste steam from the cylinder is generally conveyed by a pipe of large bore along the top of the boiler barrel to the chimney, so that a good draught for the furnace is obtained by the slight vacuum caused by the steam blowing up it. The chimney should be hinged near the base, and arranged to fold back on to a forked rest provided for it for convenience during transport. A small pump for supplying water to the boiler is fixed on one side of the barrel of the boiler, motion being given to it by an eccentric and rod on the crank shaft. This pump should be of such size that when the engine is running continuously at its maximum power the boiler is kept fully supplied. It is, however, wise to have a further water supply to the boiler provided for, by having an injector fitted. By means of this arrangement the engine can be kept working safely should anything happen to cause the pump to cease its supply,—a not infrequent occurrence when the water being pumped is dirty or contains scraps of wood, sand, etc.

The boiler of the portable engine is almost invariably of the locomotive type, *i.e.* the furnace is contained in a rectangular "fire-box" surrounded on all sides by a water-jacket, and the products of combustion, flames, smoke, etc., are led from the fire-box through a large number of steel tubes of small diameter to the chimney. These tubes, which run from end to end of the barrel of the boiler, are of course submerged in the water, and, being of small diameter and numerous, they expose a very large surface, heated by the fire, to the water. Steam is generated in this type of boiler very rapidly, a consideration which must be taken into account when it is stated that it is not the most economical type as regards fuel consumption. The essential point which constitutes the "portable" engine is the fact that it is mounted on wheels, either of wood or preferably wrought iron, and provided with shafts for horses, so that it can be drawn from place to place. When placed in position for work these wheels should be fixed in place as strongly as possible by inserting large wooden wedges back and front of them, otherwise the whole engine will tend to sway backwards and forwards with the reciprocating motion of the piston. When working near other buildings or any inflammable material the chimney of the engine should be provided with a wire cage or spark arrester, as the force of the blast of the exhaust steam will often carry small live coals out of the top and throw them a considerable distance if this simple precaution is neglected.

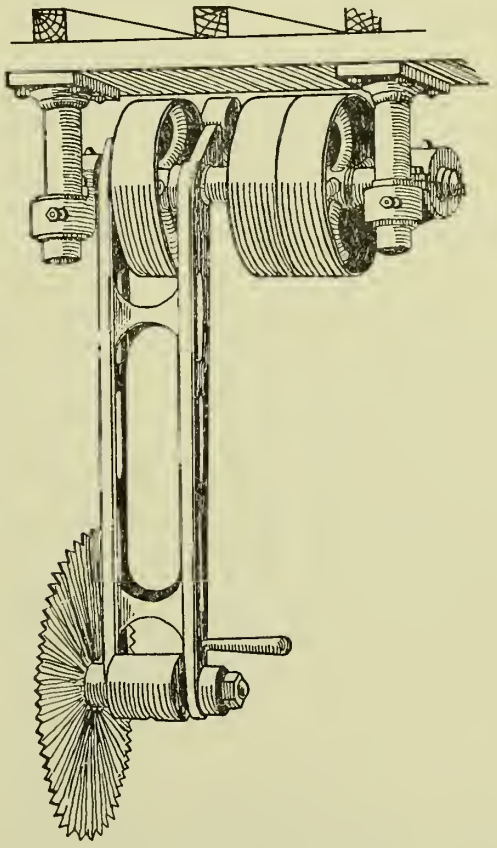


Fig. 246.

Machinery in Yard

The *Cross-Cutting Machine* illustrated in Fig. 246 is adapted to the manufacture of doors, sashes, and other joinery. It consists of a strong, yet light, iron frame, swinging freely on a counter shaft, and carrying at its lower extremity a saw spindle. The saw and frame, which are counterbalanced, are drawn by a handle across the wood to be cut, as shown. In some cases it is found more convenient to swing the frame from a counter shaft below. An iron bench, with friction rollers, fence, and gauge can be arranged for

carrying the timber, and a safety guard should be placed over the saw.

Self-Acting Saw Benches (Fig. 247) are adapted for cutting planks, deals, and battens into boards or scantlings, at a speed up to 60 feet per minute. They are made in one casting, with a steel spindle running in gun-metal bearings, and have fast and loose pulleys on the outside, the end of the spindle being carried by a strong swan-neck bracket bolted to the bench. The top is planed and polished, and fitted with a parallel fence, with lever and pressure rollers for keeping the timber to the fence. A self-acting motion, with drag rope having variable rates of feed, for drawing forward the timber, is attached to the bench, which can have

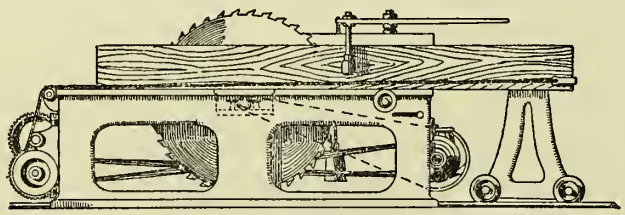


Fig. 247.

two carriages running on rails (one at each end), for cutting logs or long scantlings, one of which is shown in the illustration.

Horizontal Board-Cutting Machines (Fig. 248), which are now in extensive use, are chiefly employed for cutting thin boards from logs of mahogany and other valuable woods, also for cutting soft woods into boards, planks, etc. They are specially useful for crooked logs, which are difficult to hold and fix in a vertical frame or circular saw bench.

The saw, which cuts both ways, is driven at a very high speed; and to enable this to be done the swing frame and connecting rod are made as light and strong as possible, steel and iron tube being the materials of which they are constructed.

The slides are of steel, and are fitted with an arrangement for oiling. The bracket slide, which carries the counter shaft, is fixed to the bed-plate of the machine; and on the largest sizes the shaft can be raised and lowered by screw and hand-wheel, so that the connecting rod can always be kept at the best working position. On the smaller sizes this is not necessary, and the shaft is therefore stationary. The

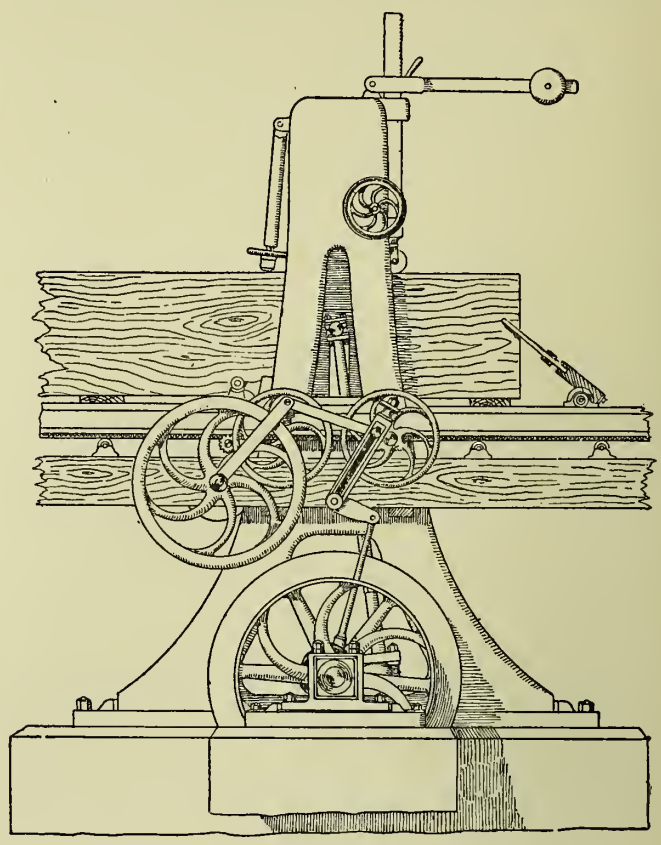


Fig. 249.

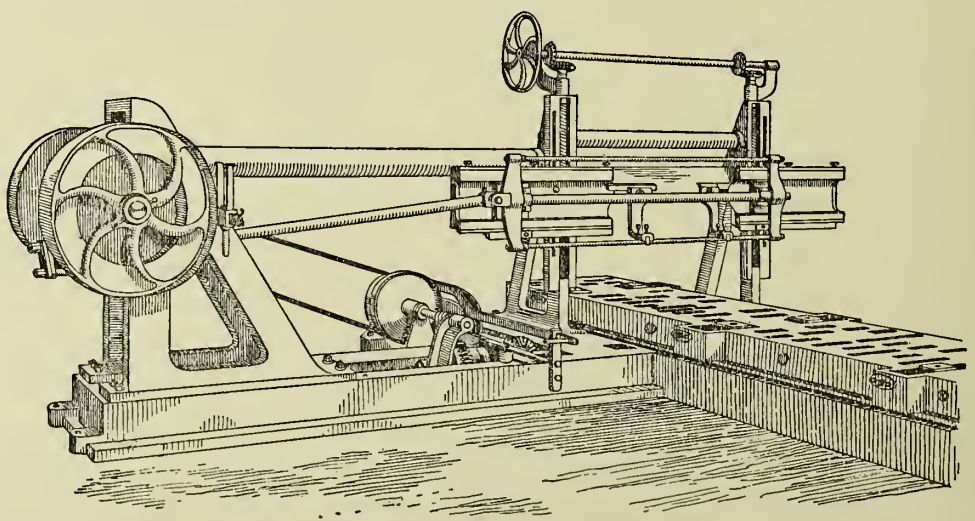


Fig. 248.

swing frame is raised, lowered, and adjusted by hand-wheel. The travelling bed has a quick motion both ways, besides the variable feed motion when cutting.

Log Frames (Fig. 249) are used for cutting round or square logs into planks, scantlings, or boards.

The timber to be sawn is placed on the cast-iron rack travelling bed, and is held by the strong wrought-iron clips, as shown. These clips, which are attached to the rack bed, have a lateral motion for following the

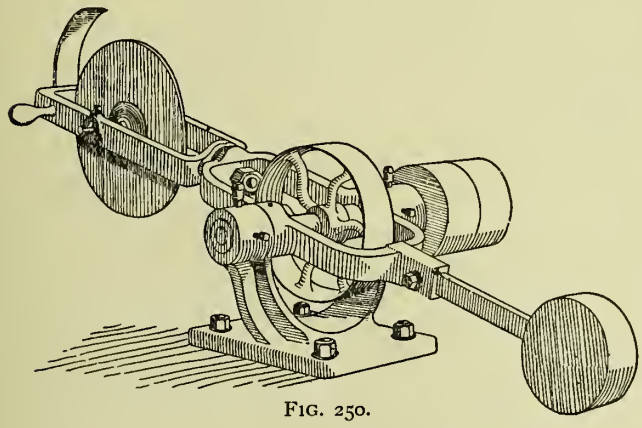


Fig. 250.

irregularities of the log. Motion is given to the racks by two pinions, one on each side, the pinions being moved by a feed-wheel, which can be adjusted whilst the frame is in motion so as to give more or less feed. The rack bed has a quick motion for running backwards or forwards.

The two uprights join at the top, and at the bottom they are bolted to the bed-plate which supports the whole. The crank shaft runs in three bearings. The connecting rods, which are long, are attached to the swing frame at the centre, thereby giving an easy motion.

Saw-Sharpening Machines (Fig. 250) are used for sharpening and gulleting circular saws. They are made to fix on a wooden bench, and to drive by motive power. The swing frame carrying the emery-wheel is counterbalanced, and the fore part of it is made to cant to suit the required angle of the tooth of the saw. The machine is fitted with fast and loose pulleys.

The belt which drives the emery wheel is not shown in the drawing.

In a Trying-up and Planing Machine (Fig. 251) the work is cramped to a travelling table, which moves in planed guides under the revolving cutters, with a variable rate of feed between 15 and 30 feet per minute. The cutter block rises and falls to adjust it for varying thicknesses of work. A true and level surface can be planed upon boards, timbers, etc., although the original surface may be considerably warped or winding; and having planed one side true, the other side can be thicknessed to it by passing the work again through the machine.

Moulding and Planing Machines (Fig. 252) will plane, mould, rebate, tongue-and-groove and work to a thickness all kinds of hard or soft timber, on all four sides, at one operation, with revolving cutters, and they are also fitted with fixed plane irons for planing the under side of the work. The feed motion consists of four fluted rollers, all of which are adjustable, the top rollers being held down by weights. The rate of feed varies from 10 to 120 feet per minute. The top cutter block is made to rise and fall, and the side spindles are adjustable, having also an arrangement for raising and lowering the cutter blocks. Pressure levers and weights are arranged in all parts of the machine for keeping the work in position, and an additional cutter block can be added for beading the under side of the timber This is placed at the delivery end. A separate counter shaft is required with fast and loose pulleys and belt gear, from which the different cutter spindles are driven.

A Vertical Spindle Moulding Machine (Fig. 253) is fitted with rising and falling spindle, worked by hand-wheel and screw, and is made both with collars and also with a square cutter block for holding the cutters. Below the cutter block is a guide collar for working circular mouldings, and there is a slot through the spindle for holding a single cutter. The table is fitted with adjustable fences, so that the opening for the cutters can be regulated, and the machine has springs for holding the work down and keeping it to the fence,

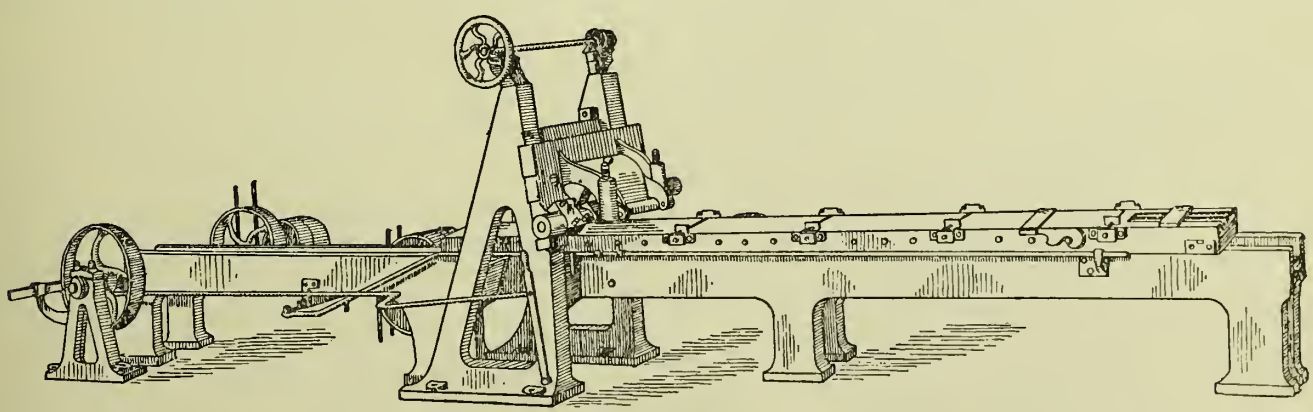


Fig. 251.

and also filling-in collars for the opening in the table. The spindle is of steel carried in adjustable bearings at the top and bottom, and it also has a steel footstep to carry the weight. All kinds of straight or circular

A separate fence for circular moulding can also be arranged to be fitted to it.

Stone-Cutting Machines.—The machines necessary to deal with the shaping and dressing of stone for building

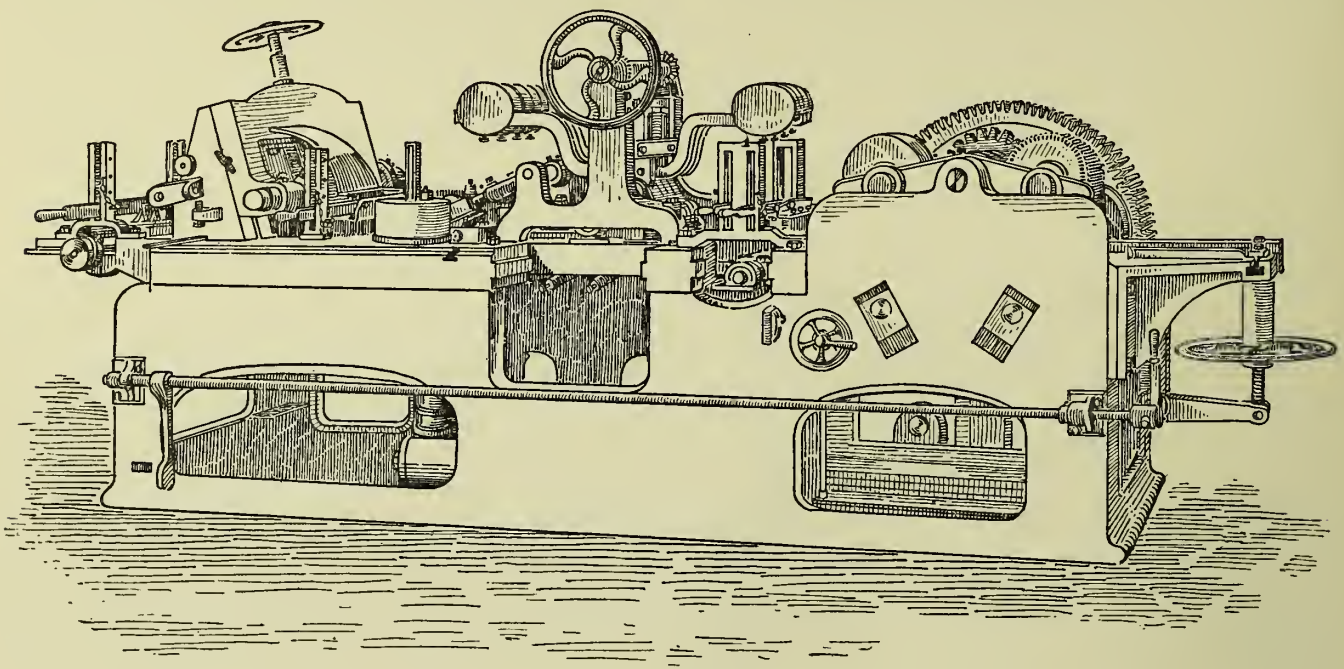


Fig. 252.

mouldings, planing, thicknessing, surfacing, rebating, tonguing, grooving, chamfering, etc., can be worked on the machine.

purposes are not very numerous. They are, however, most important, as by judicious use of machinery in this department of the works great economies can be

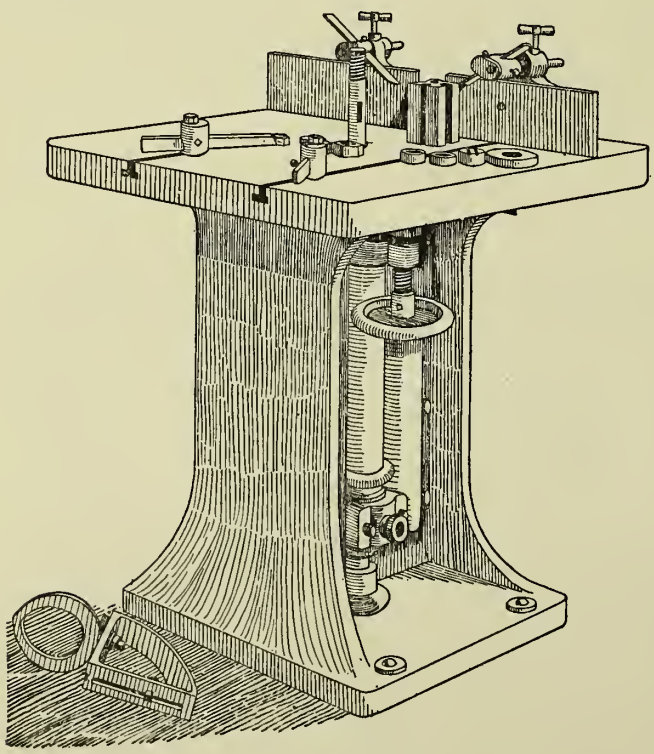


Fig. 253.

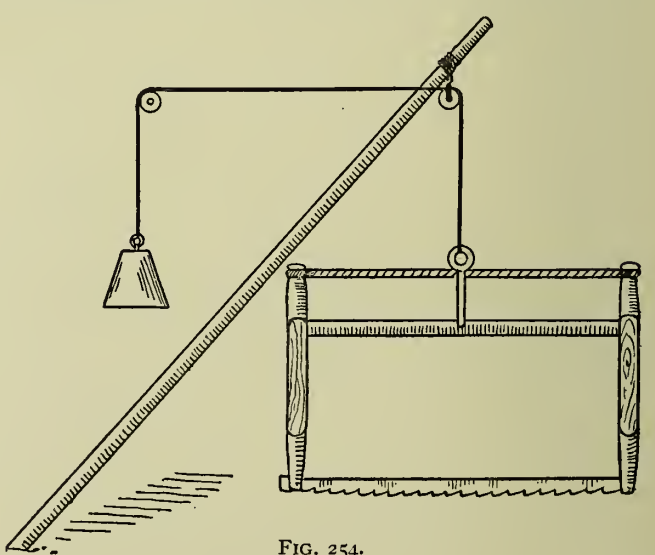


Fig. 254.

effected. The first necessity in this connection is the Frame Saw. This may be either hand or power driven. The more familiar hand-driven type is shown in Fig. 254, and consists of a rectangular frame the sides of which are made of wood, as is also the centre bar, the top of the frame being of twisted rope to give the necessary tension to the saw blade, which forms the

bottom member of the frame. From a ring in the centre of the top of the frame a cord is taken up and over a pulley, held by a pole as shown, when no other

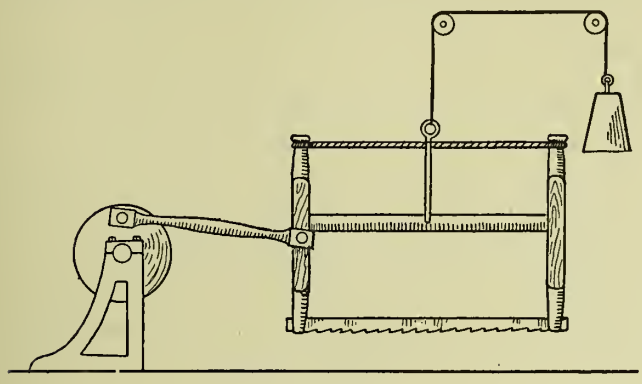


Fig. 255.

fixture is available, and to the other end of this cord a weight is attached. This has the effect of relieving the saw blade of some of the weight of the frame. The saw is operated by giving it a reciprocating motion by hand, and at the same time allowing a slight stream of water to flow over the blade and into the cut in the stone to act as a lubricant, keep the saw cool, and carry away the stone dust, which would otherwise clog together and stop the motion of the saw.

The same apparatus can be easily arranged to be driven by power (Fig. 255), the reciprocating motion being obtained by means of a revolving disc and crank pin and a connecting rod. Five or six of these saws can be fixed together in one main framework, all driven from the same shaft. They are so arranged as to be adjustable with regard to their distance from one another, and by means of this apparatus a large block of stone can be sawn into five, six, or more slabs of a given thickness in one operation.

The Stone-Dressing and Moulding Machine (Fig. 256), with its various appliances, adjustments, and attachments, will carry out practically all the operations necessary on the rough stone to bring it to a finished state. Of course, it must be understood that many cases arise in which hand work by masons is absolutely essential, but the foregoing remarks apply to nearly every form of straight moulding and flat dressing.

By reference to the illustration it will be seen that the machine consists of a flat cast-iron bed-plate, running in grooves on rollers, motion being communicated to it from a belt by means of heavy gear-wheels. Two upright brackets carry the cross-head

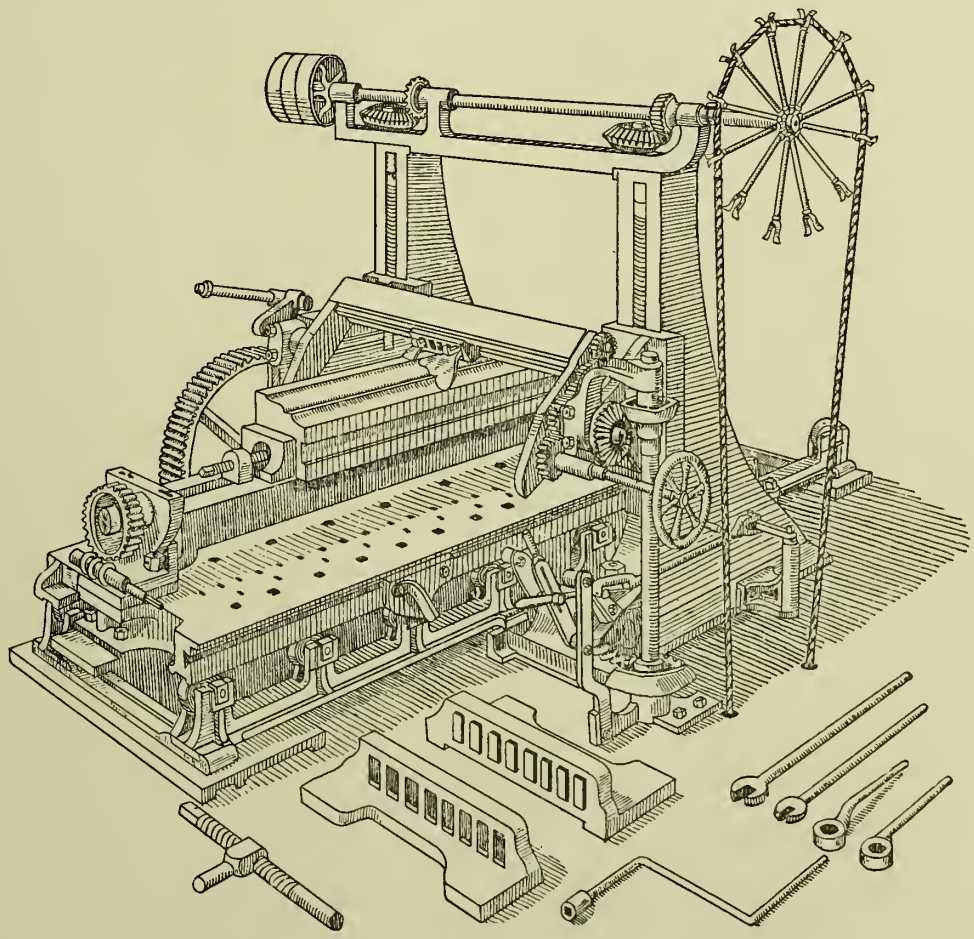


Fig. 256

which contains the tools for working the stone. The bed travels backwards and forwards, automatically changing its direction at the end of the working stroke; this being brought about by means of stops, adjustable in the slot at the side of the bed, which operate the belt-shifting gear, which in turn reverses the motion.

The cross-head can be raised or lowered slightly to alter the depth of the cut by means of the rope and rope-wheel shown at side; or if it has to be raised clear to put fresh work on the table, the belt-driving gear is brought into play and the crosshead quickly run up out of the way.

By an ingenious device the cross-head is made to "throw over" or reverse its position, and at the same time the position of the tools with regard to the stone, at the end of each stroke, so that the cutters work in both directions and no time is lost on the return stroke.

The machine shown is fitted with a patent rocking table, by means of which a stone can rapidly be turned any side up or set at any angle for working. This appliance is of great importance, as without it a great deal of time is taken up in packing and adjusting the work until it is at the required angle.

Beyond the saws and moulding machines very little more actual machinery for stone working is required; a stone rubbing bed for giving flat, true surfaces, although very necessary, scarcely being in any sense a machine, and the large nail-head and other machine-driven saws, used for hard stone, being more employed by quarry owners than general building contractors.

CHAPTER IV

THE TEMPORARY LIGHTING OF WORKS DURING CONSTRUCTION

(*Contributed by* GEORGE HIGHTON)

ALTHOUGH it is usual throughout the building trade to confine the hours of working to those of daylight, it frequently happens that, for one reason or another, a building has to be proceeded with at the highest possible rate of speed. In such cases some form of artificial light becomes necessary in order to carry on the work during the hours of darkness, and it thus comes about that the apparatus for supplying this light becomes part of the plant of every large contractor. There are several more or less well-known appliances of a portable nature in use for this purpose, a few of which are described hereunder. In dealing with electric lighting in this connection it must be understood that it is only referred to in order to set forth the economical methods of using it for temporary lighting, and in no way approaches the question of permanent electric lighting, which has been dealt with in a previous volume.

One of the best known and, until recent years, most generally used lamps for general contractors' work is the naphtha or paraffin "Flare Lamp" (Fig. 257). It is a simple and cheap appliance, and, apart from the fact that the light given is somewhat unsteady and not brilliant enough to illuminate large areas, sufficiently serviceable and safe in use. If properly cleaned at frequent intervals it will burn for many hours without any attention. The lamp consists of a large reservoir to contain the illuminant, which reservoir is placed above the burner, to which it is connected by a brass tube, the oil therefore running by gravity without the aid of any wick, and the supply being regulated by a tap or cock placed at the point where the brass tube joins the reservoir. The burner itself, which is annular in shape, is so constructed that the oil is heated considerably before it reaches the flame, so much so that it is actually vaporised, and therefore issues from the orifices in the form of vapour and under slight pressure. For this reason the flame is large and flat and the combustion of the vaporised oil nearly perfect—the outrush of the vapour from the small holes in the annular burner causing a corresponding inrush of air to the flame, on the principle of the injector. The oil supply once regulated by the tap, the lamp will continue to burn until the supply is exhausted. To start the lamp it is necessary to turn on a small flow of oil from the reservoir, and then hold the burner in the flame of a fire (often a handful of burning shavings is all that is needed) for a few minutes until it becomes sufficiently heated to cause the vaporising action before referred to. After this the functioning of the lamp becomes automatic. These lamps can be had either with a tripod support as shown, or with a ring attached to the reservoir, by which they can be suspended from a hook or nail in any convenient position.

A great advance on the Flare Lamp is the Wells Light (B, Fig. 257), a means of obtaining efficient illumination which has come into general use among

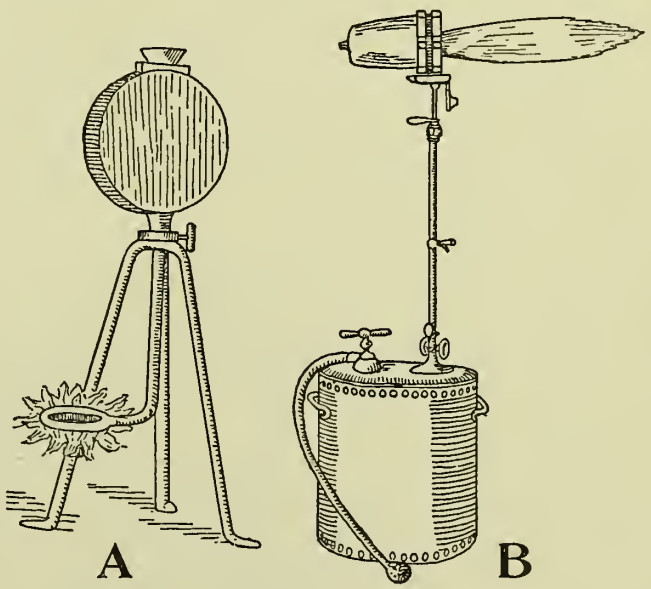


FIG. 257.

contractors more or less recently. In principle it does not differ greatly from the older type, the flame being obtained from vaporised paraffin in the same way. The essential difference consists in the reservoir being placed below the burner and the addition of an air pump, by means of which the oil is put under pressure and forced up and through the burner. The result of this arrangement, coupled with a form of burner modified to suit the altered conditions, is a large body of intensely brilliant flame of considerable length, burning with a great degree of steadiness. The oil reservoir is made large enough to contain a supply of oil for 10 or 12 hours, and is very strongly built of steel

plate to safely withstand the air pressure from the pump. After starting, the only attention needed by this appliance is an occasional pumping in of more air under pressure as the oil diminishes in the reservoir.

When the conditions under which a large building is to be erected warrant the necessary expenditure, undoubtedly the best means of obtaining light is by electricity. In London and other large cities a supply of current for this purpose can generally be obtained

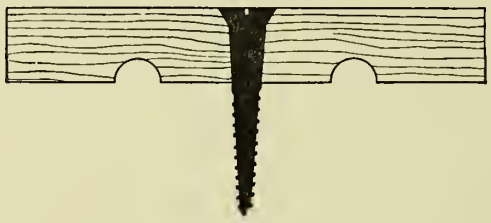


Fig. 258.

from some Electric Lighting Company's mains running through the streets adjacent to the site. While the same care should be exercised with regard to the actual jointing of the wires and cables used in this case as with cable used in permanent lighting, it is not necessary to install the same elaborate arrangements for carrying the conductors to the points where the light is required. Provided a well-insulated cable be used, it can be clamped to the beams of staging or scaffolding by means of cleats (Fig. 258) placed about 10 feet apart and secured to the timber by means of

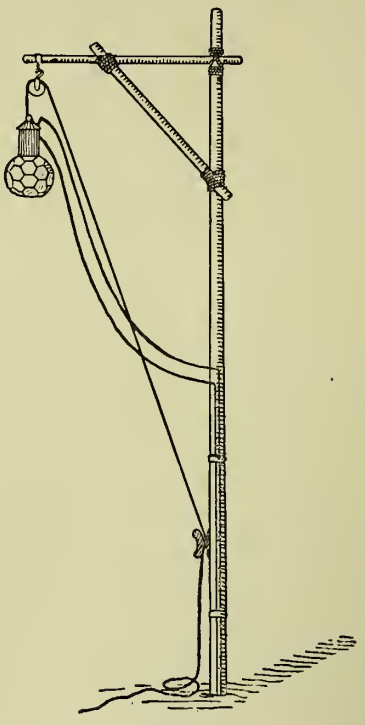


Fig. 259.

the central screw. When incandescent or glow lamps are used they can be suspended direct from the free

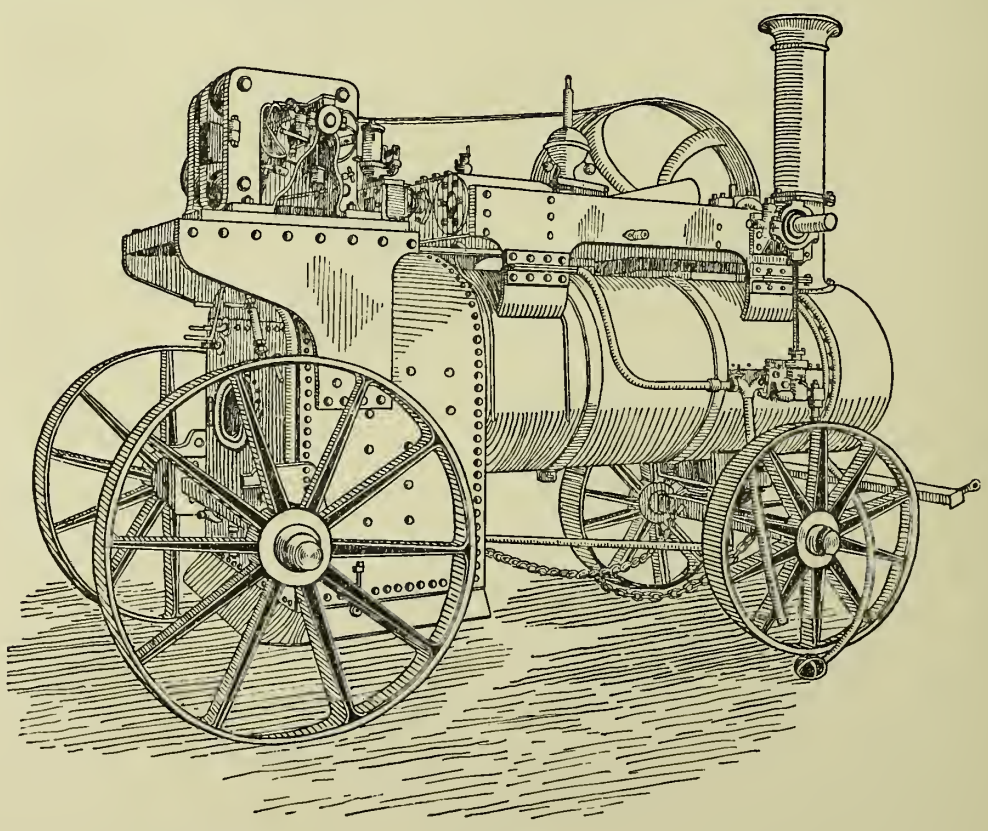


Fig. 260.

ends of the cables themselves, or branches therefrom, or they can be attached to a length of twin flexible wire so that they can be moved, within a limited area, to the most convenient position. An open wire guard should in all cases be fitted over the lamp, to protect it from any chance blow or fall.

For illuminating large areas, such as yards or the fronts of buildings, the arc lamps come into play. These can also be fitted up quite cheaply for temporary work: a scaffold pole with a cross bar at the top arranged in the form of a gallows answering very well as a means of suspension. As, however, the lamp has to be lowered from time to time to put in fresh carbons, the wiring has to be arranged to suit this. The cables leading to the lamp should be carried half way up the pole (Fig. 259) and firmly secured there, the remaining length from this point to the lamp terminals being left free. A pulley should be provided at the end of the gallows arm, and through this a small wire cord passed and made fast to the ring provided at the top of the lamp, so that it can be conveniently pulled up into position, the other end of the cord being made secure round a cleat at the foot of the pole. In no case should an arc lamp be suspended by the cables conveying the current, as the constant bending over the pulley-wheel is certain to damage them in course of time. There are several forms of arc lamp on the market, the enclosed arc type being perhaps most in favour for the present purpose, owing to the fact that the carbons are not consumed so fast as in the open type, and therefore do not require renewal so frequently, thus minimising the attention necessary. The question of the voltage or pressure of the supply company from which the current is taken has to be taken into account in this case as well as in that of power hoists, etc., and should be considered on its merits before making temporary electric lighting material a part of a contractor's permanent plant. That is to say, the cables and incandescent lamps suitable for a voltage of 100 would be quite useless for 220 or 240 volts.

With regard to arc lamps, as these can only be run at a uniform pressure of 50 volts whatever their power (or in the case of the enclosed arc, 100 volts), the question simply resolves itself into the putting of two or more in "series."

The whole difficulty is solved at once, however, if the contractor undertakes to provide his own source of electric supply. For this purpose a portable engine with a dynamo mounted upon a bracket on the boiler is the most convenient (Fig. 260). This arrangement has been proved by experience to work very satisfactorily, and the whole plant in connection with it can then be confidently counted on as a permanently useful part of the contractor's gear. A simple switchboard containing a main switch and fuse, a voltmeter, an amometer, and a suitable number of distributing switches, each having its own fuse, completes this most useful portion of the up-to-date builder's plant.

CHAPTER V

CRANES

(Contributed by George Highton)

It is only with the forms of crane suitable to the use of builders in general that we propose to deal. The whole subject of cranes in general is of far larger scope than could be dealt with in these pages, nor would it be necessary, as many of the types could not in any way be considered as builder's plant. A form much used is shown at Fig. 261, and is really no more than a combination of the crab and derrick, except that in this case the derrick, or jib as it is now called, is not held rigidly in one position by guy-ropes, but is arranged to swing from a pivot at its lower end, the pulley block at the top of the derrick being replaced by a grooved wheel built into the top of the jib. This simple crane is usually worked by hand, but in some cases is fitted with a belt-driven friction hoist or a motor-driven crab. An upright post is fixed as the main support for the jib, and the guy-ropes are replaced by two timber ties set at an angle of 120 degrees behind the jib. The jib itself can be raised and lowered through a large vertical angle by means of a tie-rope, usually of steel wire, and pulley wheel as shown, the radius through which it can work being thus increased or diminished as may be necessary. A pair of guide-ropes are attached to the jib to pull it round in any direction required.

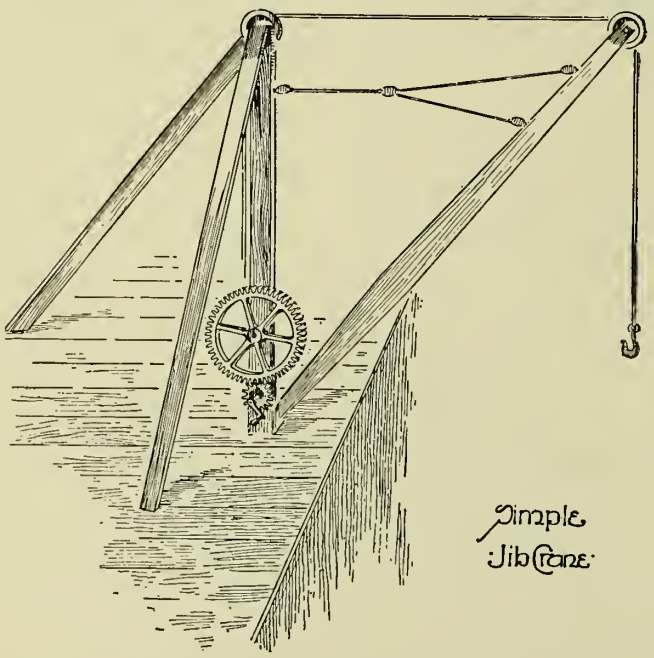


Fig. 261.

The next advance on this type of crane is that known as the "Scotsman," or Scotch crane, which is practically the same appliance, worked by steam or electricity, mounted on a high, three-legged scaffold which has been previously described. In this case the two timber ties are anchored down by means of a strong chain, fixed to the base of each and carried down the two smaller legs of the scaffold, and loaded

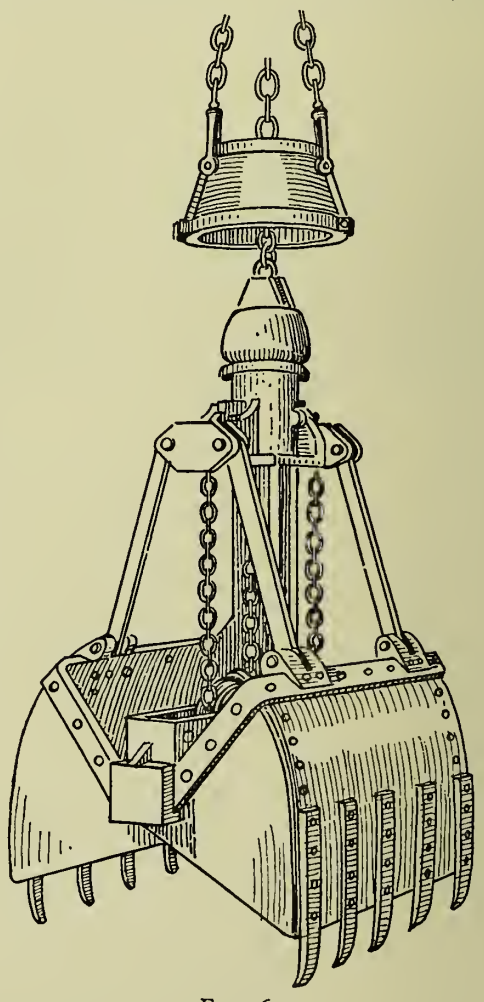


Fig. 262.

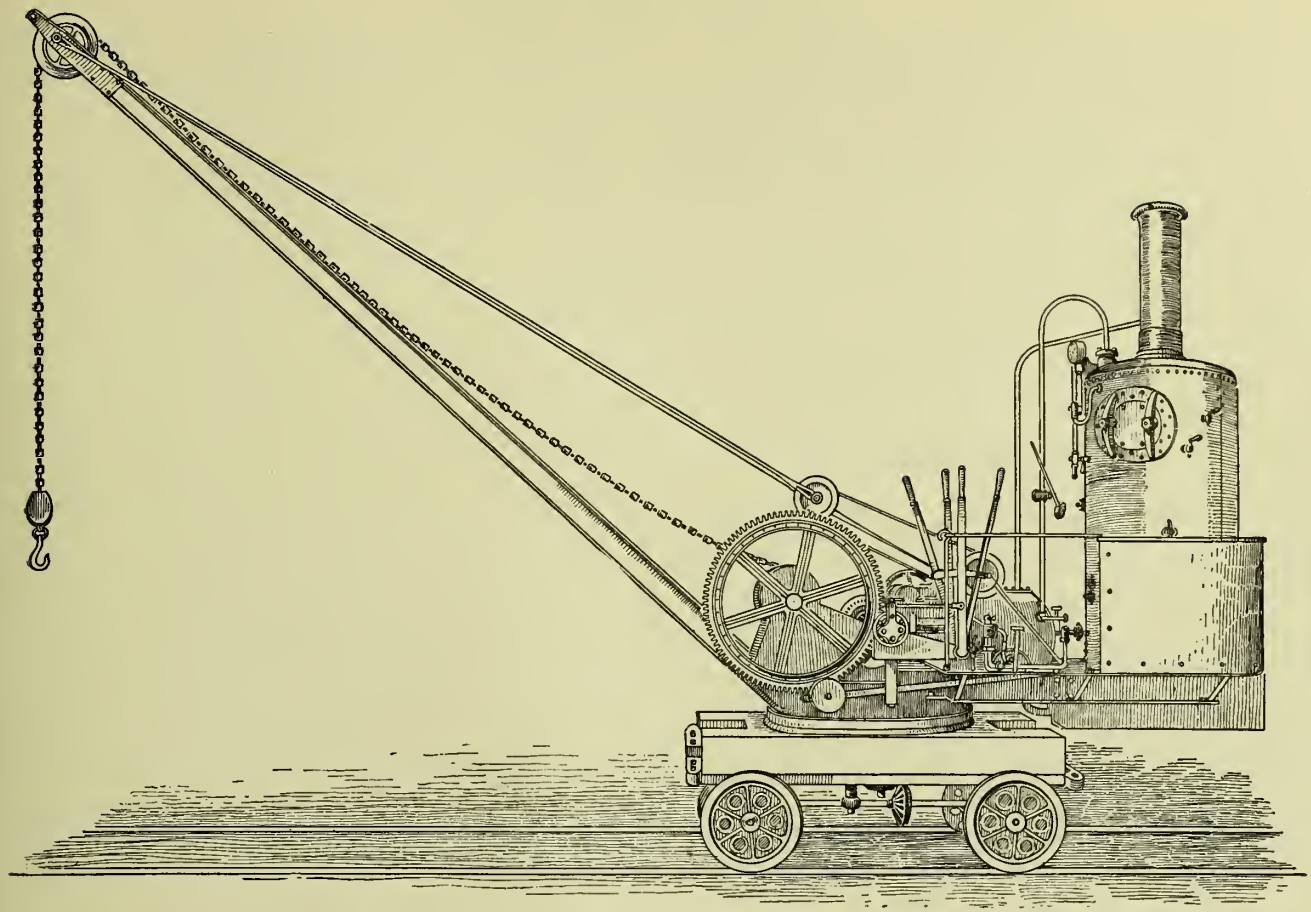
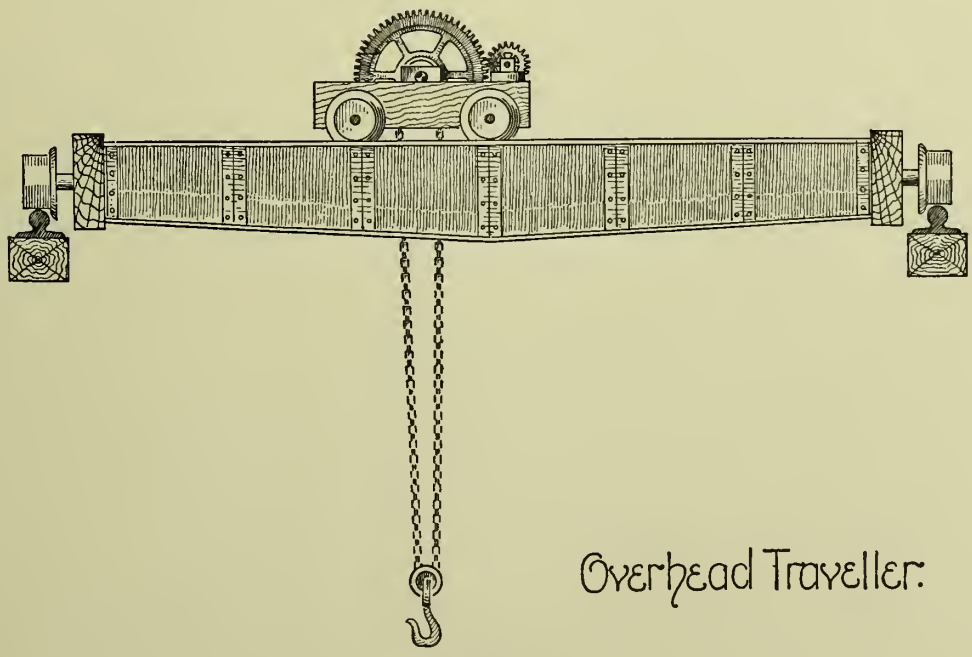


FIG. 263.



Overhead Traveller.

FIG. 264.

at the base with bricks or any other suitable weights. Care must be taken in arranging the position of the legs of this scaffold so that they do not interfere with the construction of the building, and can be conveniently removed after its completion, or rather the completion of the external walls, the legs necessarily rising through the various floors.

A type of crane which is useful during preliminary clearing of sites or excavations is that illustrated at Fig. 263. This is a self-contained travelling steam crane, which is arranged to lift, turn, and travel along the lines laid for that purpose by steam power. The boiler is placed far back in the design, with the object of counterbalancing the load and preventing any tendency to tip. By means of this appliance earth, etc., can be raised from an excavation, carried to a convenient point, and tipped direct into carts. It will be seen that this crane also consists of a jib and steam-driven crab, the traversing and slewing gear being added. Fig. 262 shows a form of grab which may be used with advantage with this type of crane when the material to be raised is of a soft or sandy nature. It consists of stout steel-plate buckets, having steel tines riveted at intervals on the outside, the plate meeting when the bucket is closed. It works automatically with a single chain, the disengaging head being attached by means of its two chains to the jib head at a convenient height to cause the grab to open and discharge its load.

The only other form of crane with which we are concerned is the overhead traveller, running on a gantry. This may be either actuated by hand, steam, fly-rope, square shaft, or electric motor. In any case it consists primarily of a double-purchase crab, mounted on a carriage which traverses rails, these rails being laid on two coupled girders spanning the gantry (Fig. 264). This form of crane can be made capable of lifting and travelling with any desired load, and with a properly constructed gantry can be used to pick up materials from vans, etc., and carry them to their destination on the work. It will be understood that such a crane could only be installed on very large work, as the cost of erecting the gantry and placing the crane thereon must necessarily be considerable. When, however, the magnitude of the contract warrants its use no more efficient appliance could be found, the time saved alone being a great factor in its favour, as well as the fact that material is much less liable to injury when conveyed direct to its destination than when passed through several hands on its way.

CHAPTER VI

SCAFFOLDING

(*Contributed by* GEORGE HIGHTON)

To enable the student to fully grasp the subject of scaffolding he should, before proceeding to read the following chapters, refer to Volume I. Part III. Chapter XIII. for a preliminary and general description of the plant in ordinary use. There he will find some particulars relating to—Standards, Ledgers, Putlogs, Scaffold-Boards, Guard-Rails, Poles, Scaffolding for Repairing Purposes, Masons' Scaffold, Communication to Scaffold, Gantries, Fixed Gantries, Travelling Gantries, Tower Gantries or Derrick Towers. In these chapters some further detailed information is afforded which, it is hoped, will be both acceptable and useful.

In the construction of scaffolding special regard should be given to the suggestions contained in the

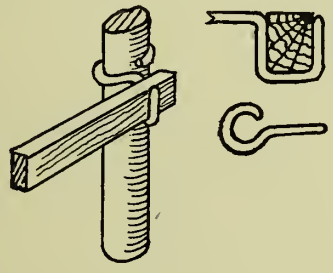


FIG. 265.

circular issued by the Home Office relating to the prevention of scaffold accidents. Up to the present there does not appear to be any legal definition of a scaffold, but a reasonable or common-sense definition—from cases which have been tried under the Workmen's Compensation Act—would appear to be that it is a temporary arrangement of poles and timber to form platforms raised from the ground for the safe approach of workmen to their work, and for the purposes of the lifting, carriage, and transfer of materials during the building operations. The nature and character of the building will determine the method of scaffolding, and to what extent the uses of braces, shores, struts, etc., may be required.

It is well to give special attention to the Home Office suggestion as to *Working Platforms* 10 feet or over above the ground level. Before employment takes place thereon they should be provided throughout their entire length on the outside and at the ends—(1) with a guard fixed at the height of 3 feet 6 inches above the scaffold boards, openings being left if necessary for workmen to land from the ladders, and for the landing of material; and (2) with boards fixed so that their bottom edges are resting on or abutting against the scaffold boards. Boards so fixed should rise above the scaffold not less than 7 inches. It is also suggested that all *Runs* or similar means of communication between different portions of the scaffold or building should not be less than 18 inches (two boards) wide. If composed of two or more boards, they should be fastened to either in such a manner as to prevent unequal sagging, by screwing or nailing pieces of 6 by 1-inch batten across their under sides every 4 feet. When nails are used they should be of wrought iron, and long enough to go through the boards and be clinched on the top side.

Reference is also made to the necessity for removable guard-rails to close the openings referred to in the manner shown in Fig. 265, a piece of $\frac{5}{8}$-inch iron bar being bent into a hook at one end and an open ring at the other, so that it may be slipped over the end of the scaffold pole, the ring being closed or opened as required, and a pair of such ring hooks carrying a length of 4 by $2\frac{1}{2}$-inch rail.

Derrick Stagings.—The construction of Tower Gantries has already been alluded to in Volume I. Part III. Chapter XIII. The importance of carefully determining the exact position or positions of the "Scotsmen" is evident, having regard to the most convenient working of the cranes and jibs. The king leg (being the largest) upon which the crane is fixed is the first to be erected (see Fig. 235A, Vol. I.). The queen legs are then set out from it to form a triangle. The length of the sleepers required (usually from 25 to 30 feet) determines the distance between the king and queen legs. The legs should have a concrete or other solid foundation if possible, but where this cannot be obtained two thicknesses of 3-inch timber laid cross-wise and fixed 2 feet below ground level should be laid to a dead level.

The framework of 12 by 2-inch timber to carry standards is then fixed. The legs may be from 6 to 10 feet square on plan, according to requirements. The standards (four to each leg) may be either solid or laminated; *i.e.* those of the king legs should not be less than 9 by 9 inches solid, or if laminated should

consist of three pieces of battens 9 by 3 inches bolted together.

The queen legs should have balks of timber 7 by 7 inches, or three pieces of batten 7 by 2½ inches bolted together.

If whole timbers can be obtained they ought to be used.

It is better that the king leg, having to carry the weight of the engine, should have balks of timber 14 by 14 inches, and if built up four deals, 16 by 4 inches each should be used.

The king leg should have an extra balk laid with the horizontal framing at bottom.

To prevent any winding or bending an extra standard up the centre of the leg should be fixed and strutted from each of the four outer standards, and behind each transom (see Fig. 266).

The central standard may, however, be supported from the foundation. If made in this way the legs would support a platform over 100 feet in height.

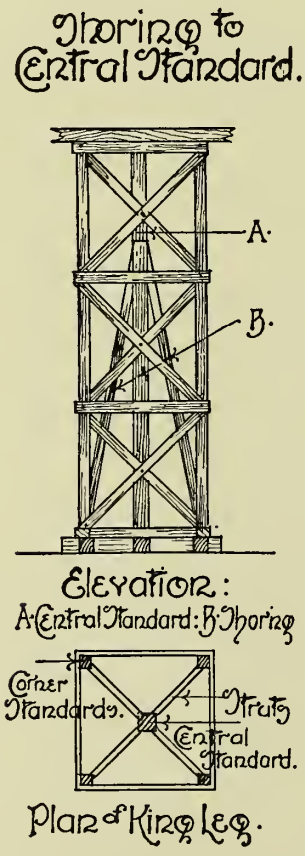


Fig. 266.

The top timbers have a projection from the king leg of from 6 to 8 or 10 feet beyond the king leg, and are halved at intersection. These projecting ends are connected to each other by 8 by 6-inch balks, and again to the return balk by pieces of similar scantling. The top balks are supported by struts from the central standard (see Fig. 267). The upper and lower balks

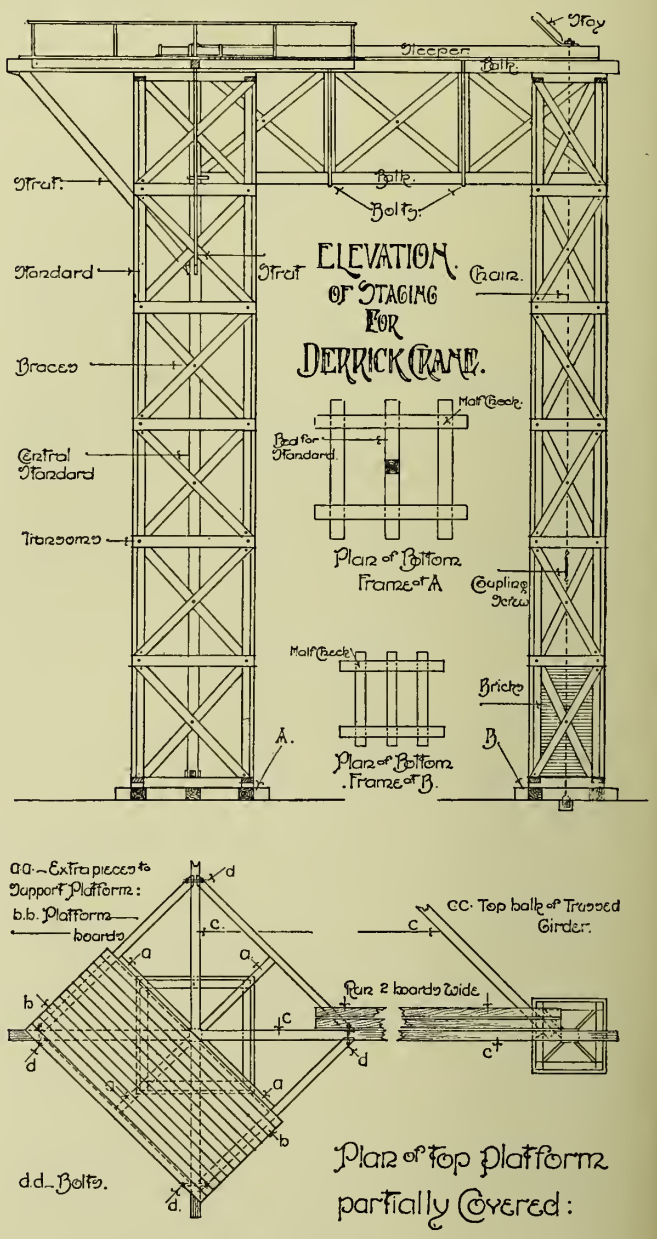


Fig. 267.

The legs are connected by trussed beams thus. Two pieces of timber, each 12 by 8 inches, are laid one above the other between the king leg and each queen leg on the two top transoms (see Fig. 267). They are from 6 to 9 feet apart, the top bay being made lower than the others.

The lower balks are secured to the centre standard of the king leg by wrought-iron straps.

are connected as shown by iron bolts, and each bay is diagonally braced, as are the bays to legs. These iron bolts should be covered by pieces of the same scantling as the cross pieces or braces.

The top balks having been continued, a larger area to the platform round engine is thus afforded. The boards, usually 9 by 1½ inches, are laid at right angles to the joists, or on poles about 3 feet apart.

These joists or poles are laid parallel to one another and at right angles to the truss, forming the back support of the platform.

Although it may only be necessary at times, and according to circumstances, to partially cover the space between the legs (see Fig. 267), it is very desirable to adopt the plan of thus securing a larger platform as a space for the storage of engine coal, the weight of which would help to keep the framework of the structure steady. Where coal or other heavy materials are stored the floor of the staging or platform should be of double thickness.

The platform is reached in various ways. The ladders are sometimes fixed to the inside of king leg or on the outside of queen leg, but to avoid the danger

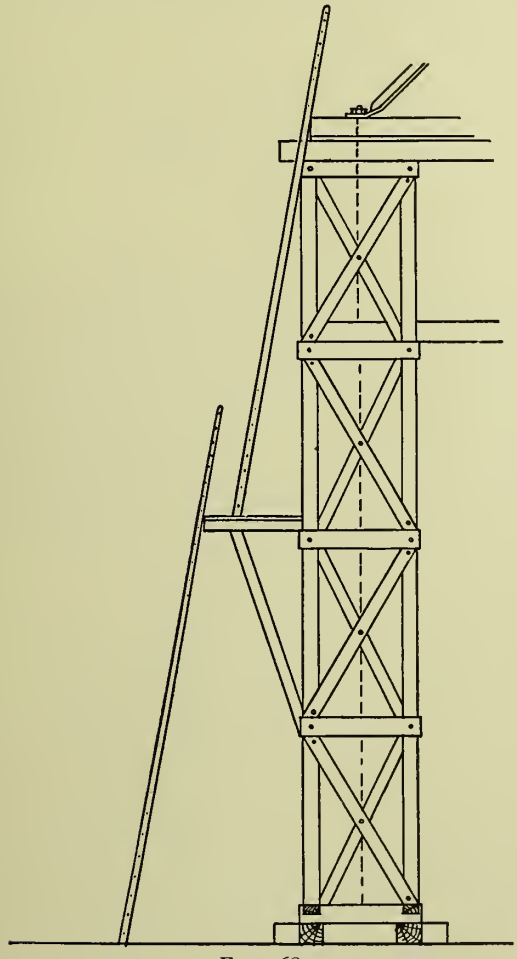


Fig. 268.

of climbing upright ladders, as would arise in those instances, it is desirable, if possible, to fix the ladders as shown in Fig. 268.

It should be observed that additional security against any possible lateral motion, consequent upon the effect of wind, etc., can be made by cross-bracing by poles or scantlings between each leg, as shown in Fig. 269.

In the erection of long buildings it is not unusual to construct the derrick on a travelling bogie rather than to reconstruct it elsewhere on the site. This arrangement (see Fig. 270) applies to small derricks,

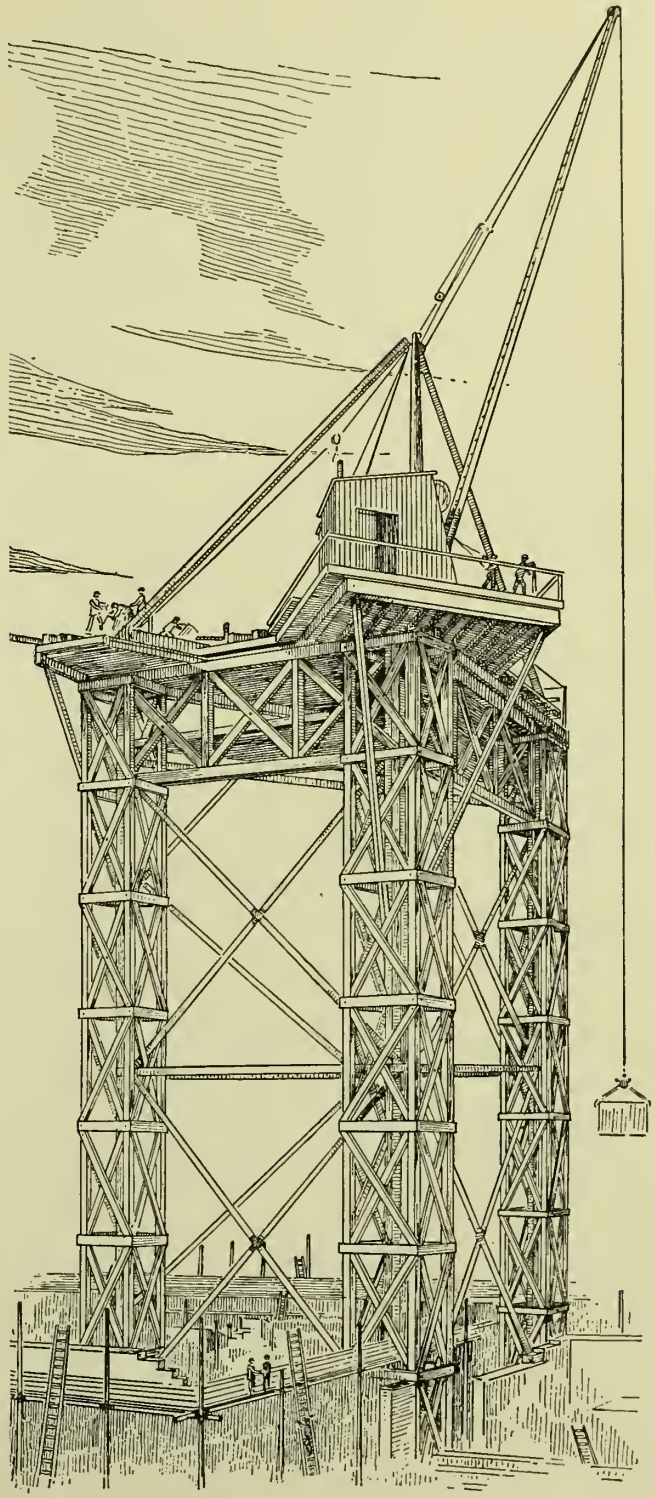


Fig. 269.

and is usually adopted when the crane is erected outside the building.

A platform for travelling cranes should be constructed as follows, and as shown in Fig. 271. As these plat-

forms or gantries are used in builders' yards, and in those of stone masons and timber merchants, as well as upon extensive building works, it is obvious that they should be firmly and solidly built, framed, and braced. Balks of timber forming standards in two parallel tiers are placed about 9 or 10 feet apart longitudinally, and from 20 to 30 feet transversely. The heads to standards and the sleepers also should to the gantry, it is desirable to brace it on the inside, as shown in Fig. 272.

As stability is essential to the erection, bracing between each bay longitudinally, and at least every second bay transversely, should be adopted. The runners should be strutted on their under side from the standards (see Fig. 271). If the struts (which should not be less than half the sectional area of standard)

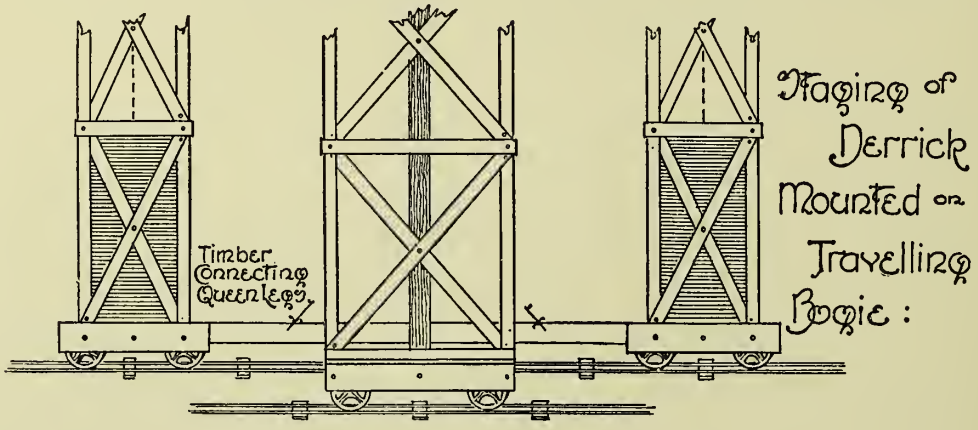


Fig. 270.

be of same scantling at least as standards themselves, and be thoroughly braced in every way possible to render the structure firm and free from any likelihood of displacement. Head pieces as shown should be fixed between to distribute the pressure. The runners are laid on the head pieces, and consist of railway metals resting in chairs bolted to heads. Along these runs a small but strong carriage called the "traveller," formed of two stout *trussed* beams, rested on and bolted are of the same scantling as standard and head, about double the weight can be carried. The cleats which support these struts should, for additional strength, be housed into the standards.

For the purpose of stability and of preventing any lateral movement, cross bracing at ends should be adopted. In cases where perfect rigidity and strength are specially needed, and where the space between each row of standards must be kept open for building

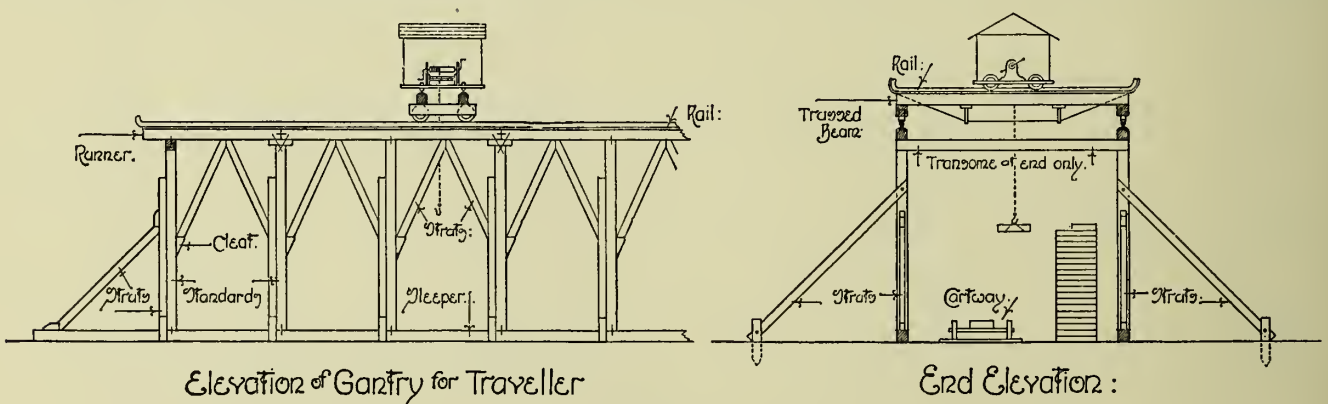


Fig. 271.

to two short cross beams which are mounted on pairs of flanged wheels. The traveller moves longitudinally along the gantry, and carries the crane, winch, or crab. In this way a universal motion for any load carried by the crab is obtained. It is absolutely necessary, in constructing these erections, that the ends of the rails should be turned up some inches to prevent the traveller or winch carriage running off the metals; and in order to render additional strength and firmness purposes, and where no cross bracing could be permitted, strutting to each standard, as shown in Fig. 291, will be needed. The struts are secured by bolting to standards near the top, and to a foot block driven into the ground.

When platforms or gantries are needed, mainly to allow of free passage along a footpath, they are of lighter form than those previously described, inasmuch as strutting is not necessary; but so far as the framing

of sides is concerned, the method is similar to that required for travelling gantries (see Fig. 273, and articles on Gantries, pages 150, 151, Volume I.).

Stagings are constructed similarly to travelling gantries. Now that the Scotch derrick system is generally adopted in large buildings, stagings are not so much needed as formerly. It is, however, necessary to mention them for reference.

The construction of the first runner is exactly the same as that of gantries over footpaths (Fig. 273), but

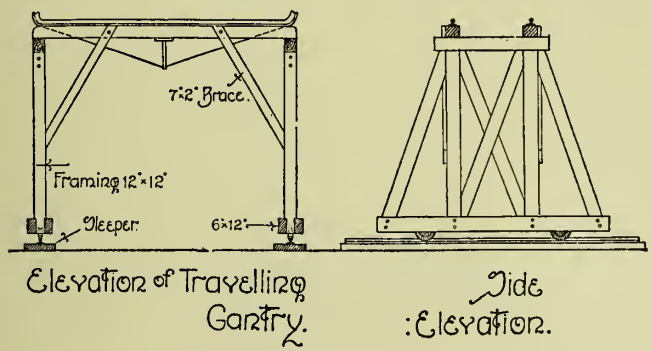


Fig. 272.

as the scaffolding may be required to be carried up higher it will be necessary to lay horizontal pieces across the scaffold over each standard, and to project them for 8, 9, or 10 feet as required beyond the face of runners, and connected longitudinally by transoms (see Fig. 274). It will be seen that the rising tiers of standards are strutted from the projecting part of the beam called the "footing piece." This "footing piece" is supported by struts from the lower standard, and so bolted to the sides of "footing piece" and

temporary purposes dog irons may be used for connections, but bolts and straps should be used in permanent structures.

Pole Scaffolding.—For a general description of

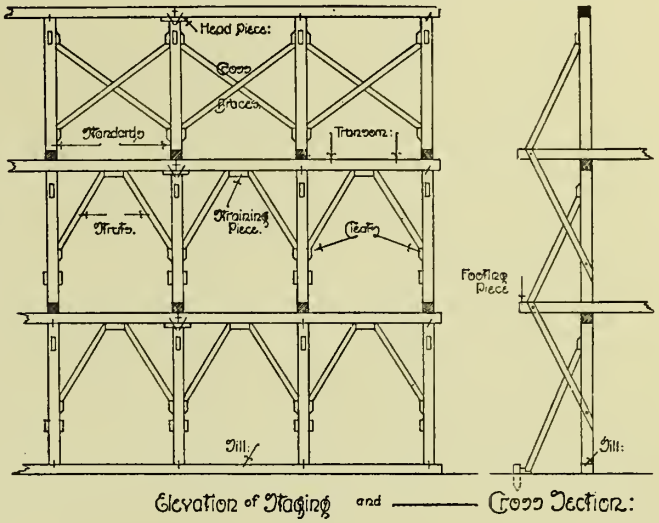


Fig. 274.

bricklayers' and masons' scaffold, see pages 149, 150, Volume I.

In Fig. 232 of that volume it will be observed that single poles or standards are dealt with. Where no great weight or great height are required single poles are sufficient, but double poles should be used if heavy weights or a considerable height are to be dealt with.

In the case of double poles, the first pair are erected of different lengths. This difference of length permits of a lap in connecting the succeeding poles, the lap

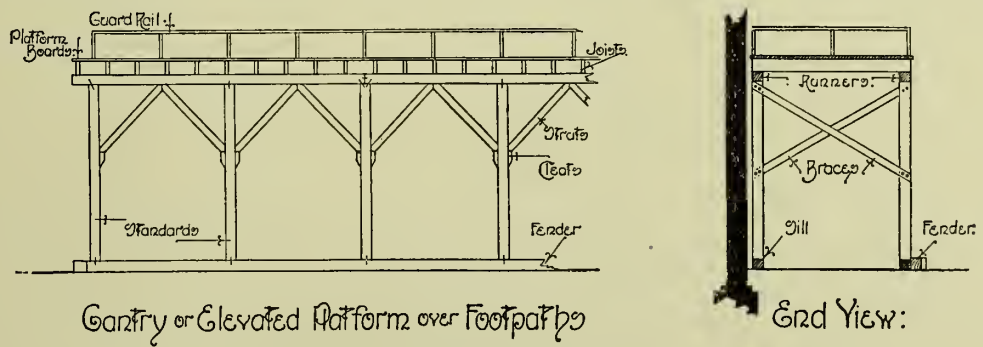


Fig. 273.

standards as to allow of the passing of the shores from footing piece to standard. The strutting to the bays formed by the standards and the cross-bracing to top tier are carried out as shown. The rails for travellers are laid on top runners as before described.

Particular care should be taken that all the uprights of the upper tiers should be placed exactly over those of the lower ones, so that no cross strain should occur to the runners. It is very important that the joints of the runners should be immediately over the standards.

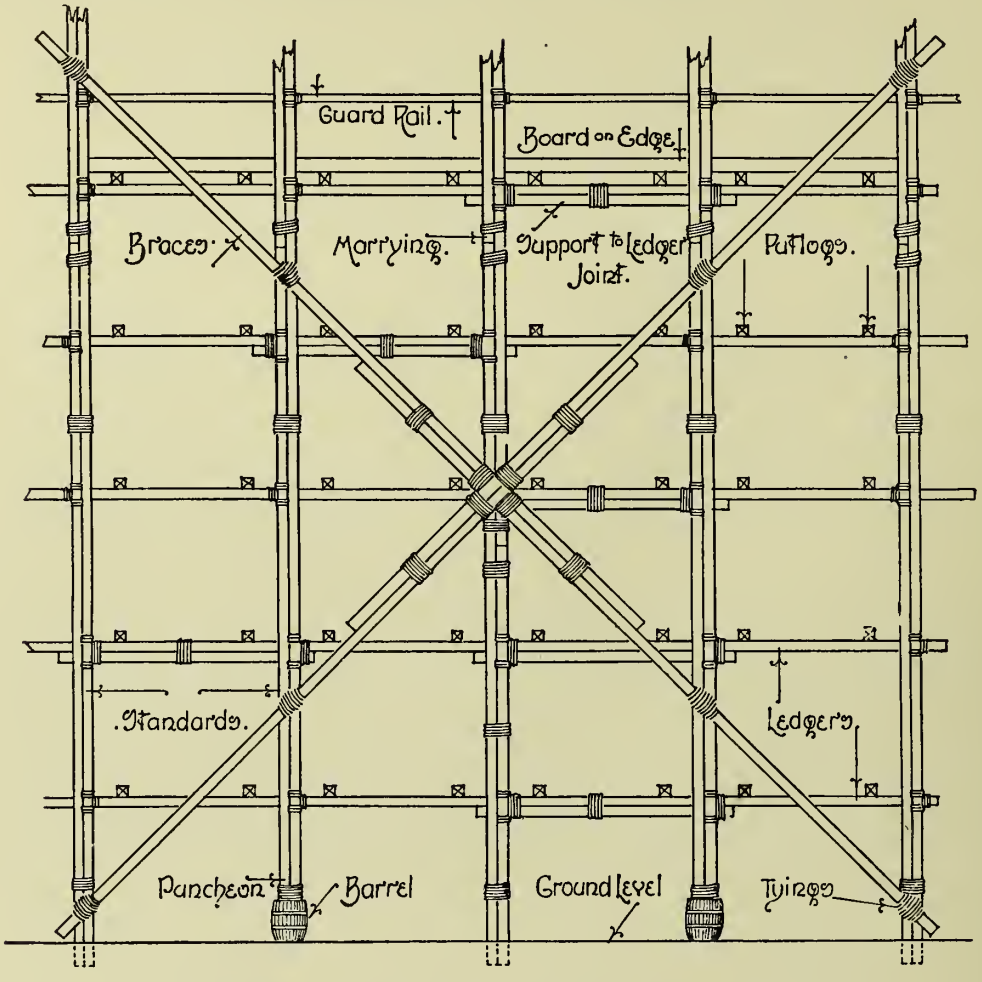
In cases where the erection is only required for

being equal to half of the full length of pole. The short pole is called a "puncheon." Where the nature of the earth will permit, the butt-ends of the poles should be set from 2 to 3 feet underground and the earth well rammed round them. If, however, this cannot be, the ends should be placed in barrels and filled in with earth closely and lightly rammed (see Fig. 275).

Should the standard be a single pole the second pole in height should have a lap of 10 to 15 feet, and stand on a putlog close to the first pole (see A, Fig.

276). The inner end of putlog is securely fixed to the scaffold or into the building.

The standards are spliced or "married" together to form a continuous ledger it will be desirable to arrange that the putlogs should lie evenly and on the strongest support.



Elevation of Pole Scaffold

FIG. 275.

with band ties. A ledger is tied across the standards as a support for the working platform at a height of about 3 feet, to admit of a man working with ease.

In cases where a single pole is not sufficiently long

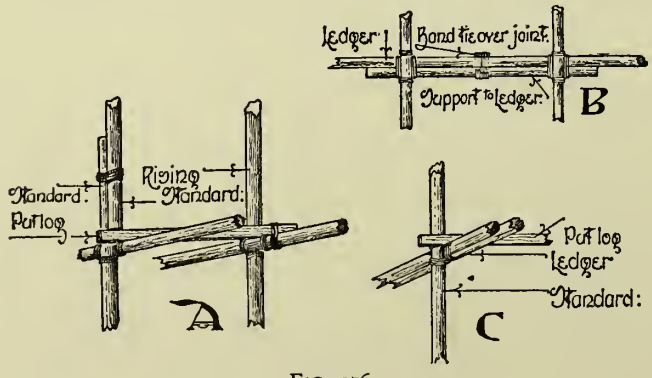


FIG. 276.

There are various methods of ledger-lapping, but the best and most reliable is shown at B, in Fig. 276. It will be seen that the ledgers' ends butt one another. A short pole is fixed across the two standards, and tying at the standards a double ledger is formed.

Another way is to lap the ledgers horizontally as at

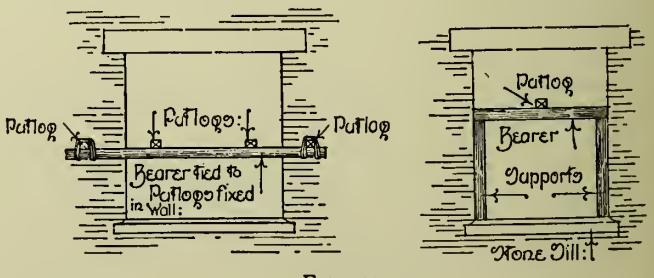


FIG. 277.

C, but although evenness of the putlogs is obtained it is not so strong.

It will happen sometimes that the putlogs cannot be carried into the wall, on account of a window or other opening. In such a case they are supported in one of the ways shown in Fig. 277.

The wedging in of the putlogs to the wall is not

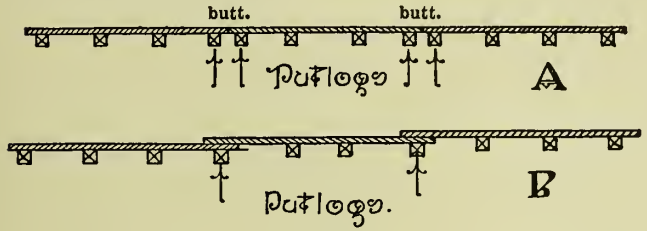


Fig. 278.

absolutely reliable, for although some strength may be imparted to the scaffold, a slight strain might be quite enough to draw the putlog.

Pole scaffolding should be strengthened and stiffened longitudinally by braces tied on the outer side of the scaffold, as shown in Fig. 275, at all crossings, and connected to all main timbers of the scaffolding with

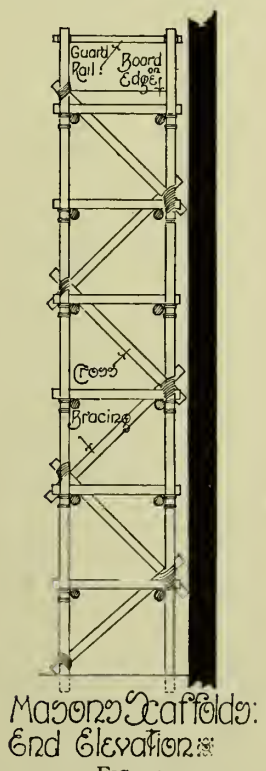


Fig. 279.

which they adjoin. These braces should always be used in exposed positions where the height of scaffolding exceeds 30 feet. Of course, there would be difficulty in carrying out the bracing in cases of irregularly shaped buildings, but although the scaffold may, in such instances, butt or break with return walls, it would be well to adopt it if and where possible.

In order to secure level boarding over the putlogs the boards should butt as shown at A, Fig. 278, when two putlogs should be placed about 4 inches apart. If, however, lapping of the boards has to be adopted, one putlog only would be required, as shown at B. The former method is more satisfactory.

Masons' Scaffold.—The Masons' Scaffold has been referred to on page 150, Volume I. Further attention may, however, be drawn to it (see Fig. 279), from which it will be seen that two parallel frames of standards and ledgers are erected along the line of wall. The inner frame should be constructed as close as possible to the wall. The standards in such scaffolding should be from 4 to 5 feet apart, with ledgers and braces fixed as before; but the putlogs would now rest on ledgers at each end, and not as in bricklayers' scaffolding. Special attention should be given to bracing—the inner and outer standards being connected by short braces across each bay as shown.

It is often necessary to provide a landing or platform on which the stonework or other material can be deposited (see Fig. 280). Face boards should be fixed to prevent the stone or load catching the under side of ledger and so being damaged.

It will be interesting to note the names of some of

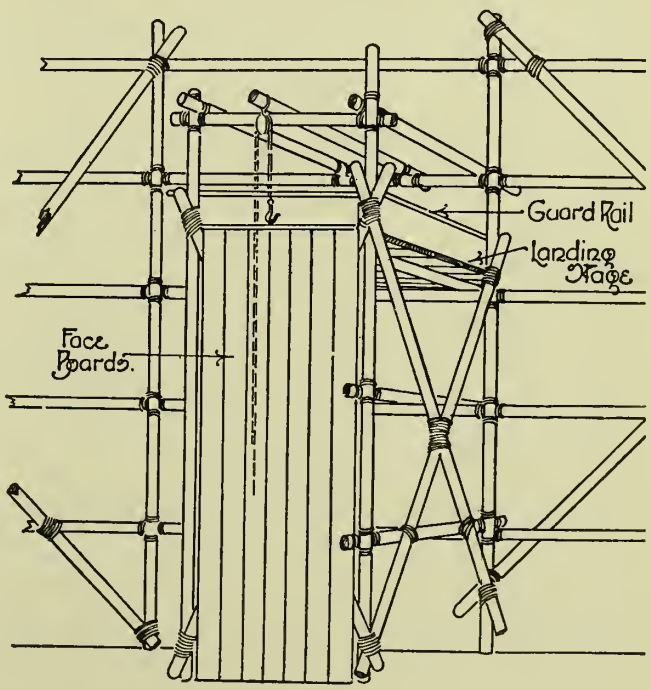


Fig. 280.

the knots in use for buildings and scaffolding purposes, illustrations of which are given in Fig. 281.

1. *Overhand or thumb knot.*—Prevents the opening out of end of rope, or passing through the sheaves of a block.

2. *Figure of eight knot.*—Prevents the opening out of end of rope, or passing through the sheaves of a block.

3. *The bend or weaver's knot.*—For joining ropes together or securing a rope through an eye splice.

4. *Wolding stick hitch.*—Used in connection with a pole employed as lever.

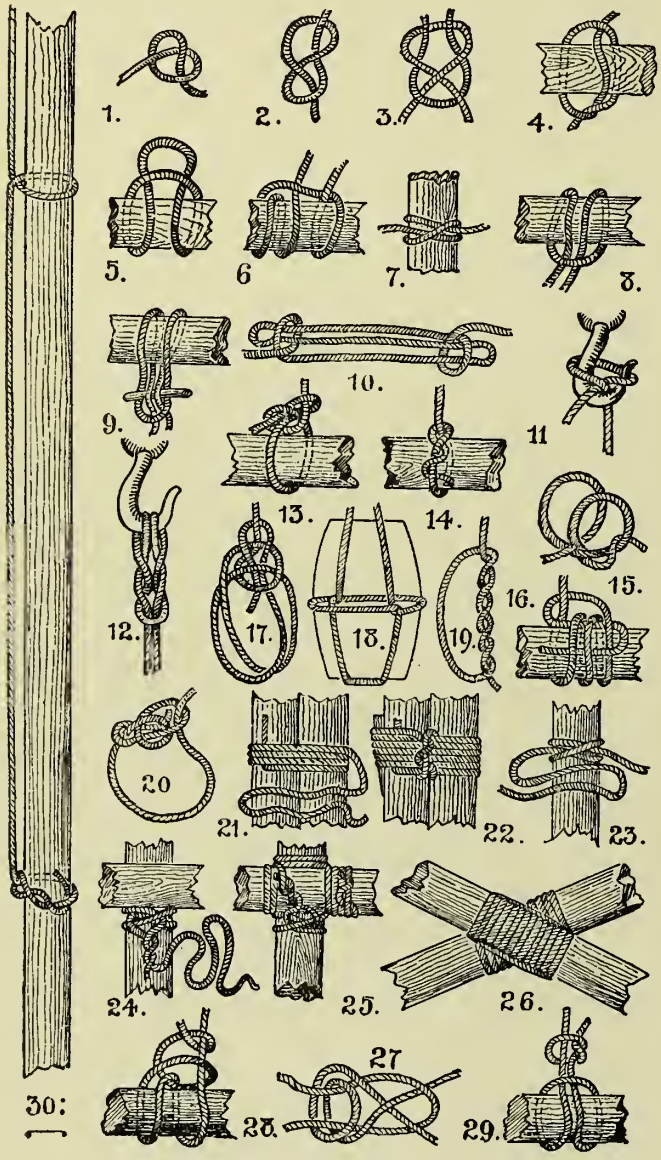


Fig. 281.

5. *Bale sling.*—For hanging on to hook of lifting tackle.

6. *Magnus hitch*, or *Rolling hitch.*—For lifting material.

7. *Two half hitches*, or *Builder's knot.*—Used for tying ledgers to standards.

8. *Clove hitch*, or *Loop hitch.*—Used where ends of ropes are not available.

9. *Loop knot.*—Used where ends of pole are not available.

10. *Sheepshank*, or *Dogshank.*—A method of shortening a rope without cutting it or reducing its strength.

11. *Midshipman's hitch.*—Used as shown with rounded hook.

12. *Catspaw.*—An endless loop—used where great power is required.

13. *Capstan knot*, or *Bowline.*—When tightened it will not slip.

14. *Timber hitch.*—For carrying scaffold poles. Take turn round pole, and finish with jamming turns.

15. *Artificer's knot.*—Or half hitch and overhand.

16. *Topsail halliard bend.*—Used as a timber hitch.

17. *Butt*, or *Barrel sling.*—When placed horizontally.

18. *Butt*, or *Barrel sling.*—When placed vertically.

19. *Double overhand knot.*

20. *Running bowline.*

21 and 22. *Marrying*, or *Splicing band tie.*—Start as shown in No. 21, and when end of rope is nearly reached take the rope twice between the poles and round the turns already made, and finish with jamming turns. Then tighten with a wedge.

23, 24, and 25. *Tying between standard and ledger.*—Start with two half hitches as shown in No. 23. Then twist ropes together as far as possible, and then place ledger in position above the hitches, No. 24. The twisted ropes are then drawn up in the front of the ledger to the left of the standard, taken round the back of the standard, brought again to the front, and round ledger to the right of the standard, then cross in front of the standard, and round the ledger at the left of the standard, and brought up and carried round the back of the standard. Finish with jamming turns as shown in No. 25.

26. *Portuguese knot.*—Used for shear legs. Made by several turns of the rope round the poles and interlaced at ends.

27. *Double bend.*—Where a small rope is to be bent on to a larger one this is useful. The end of the rope is given an extra turn round the bight of the other, with the result of considerable increase in strength.

28. *Fisherman's knot.*

29. *Lark's head.*—Fastened to a running knot.

30. This is a method of raising scaffold poles to a vertical position by using the timber hitch and half hitch. If the upper end should be required to be free while the pole is being carried, the half hitch can be replaced by a cord tied round the pole and the lifting rope.

PART III

SOUTH AFRICAN PLANNING AND CONSTRUCTION

CHAPTER I

DWELLING HOUSES

(Contributed by H. S. East, A.R.I.B.A., Soane Medallist and Aldwinckle Student)

Planning and Arrangement.—Probably the climatic conditions are almost entirely responsible for the differences in the arrangement of South African houses as they exist to-day from those of other countries. The old Dutch farmhouses still sparsely scattered over Cape Colony, the oldest settlement in South Africa, have little or no influence on either latter-day planning or construction.

There can be no question that these houses have and had at least the merits of coolness and suitability to their immediate surroundings. The thatched roofs, thick sunburnt white plastered walls, the upper or attic storerooms approached by an outside staircase usually at side of house, and the lofty rooms all contributing more or less to this satisfactory result; whilst the style architecturally, with its quaint gables, doors with upper and lower halves, small paned large windows with panelled shutters to the lower half, although differing considerable from its parent in Holland, seems to harmonise quietly and most effectively with the rolling veldt and towering mountain scenery of the Cape Peninsula, and this harmony is specially helped by the masses of oak trees invariably planted by the original founders.

The internal arrangements, however, by which each or nearly all the rooms communicated one with the other, lack the privacy dear to the heart of the English side of the community at least, and are not therefore altogether suitable to present conditions, mode of living, etc.

The modern development of South African life has resulted in the centering of the bulk of the populations in towns and their outskirts. The natural outcome of this has been to crowd houses and population together, although not by any means to the same extent as in any or all of the European countries,— not even excepting those whose climate approaches more nearly that of South Africa.

Many houses have been built, and many will doubtless continue to be built, even in the towns themselves, as well as their suburbs, on such an amount of ground as may be necessary to show the architectural characteristics; still, as a rule, the area is too circumscribed to allow of successfully arranging a house satisfactory in all points. Town houses, such as are commonly arranged in the more or less aristocratic neighbourhoods of London and other large cities, are practically unknown. Terrace houses of one, two, or three storeys, and even semi-detached ones, are still in the minority.

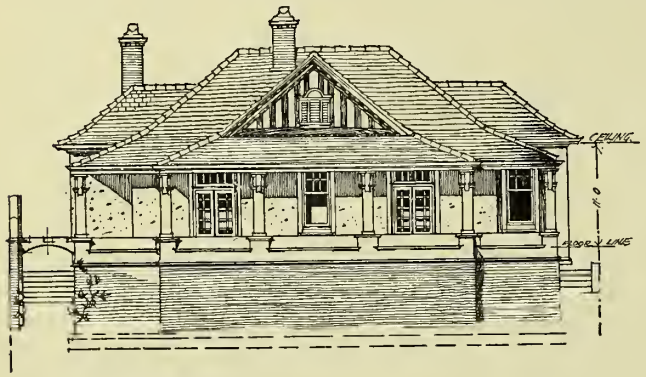
The principal problem which the architect has had to face in house planning in the past, and seems still likely to have to meet, is to arrange a satisfactory dwelling on a site of 50 feet frontage by 100 feet deep (Cape feet—equalling respectively 51 feet 6 inches and 103 feet 0 inches English), with the probability that the house required on such a plot will be of one storey only.

This subdivision and similarity of size of plots has naturally caused a hackneyed style to spring up, the planning usually being faulty, and the elevation commonplace and tawdry to a degree, and the arrangements (especially the lighting and outlook of bedrooms) of such a kind that the houses are anything but exhilarating to live in.

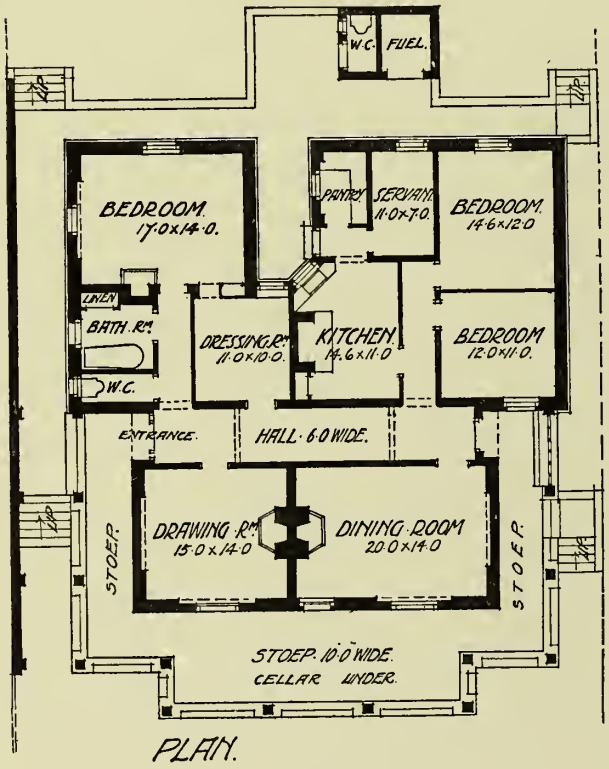
To add to these disadvantages, estates are cut up into plots (always approximately of the above-mentioned size), and plots are sold singly or otherwise without any restrictions as to class, quality, or appearance of the houses to be erected, except perhaps for a proviso that no houses built on the ground shall be occupied by the coloured people. It is therefore not infrequent for a man, who has as a pioneer built a house of consider-

able attractiveness both in size and appearance, to find it surrounded by a row or series of houses squeezed each on a plot of ground very little longer and very little broader than themselves—a juxtaposition, to say the least of it, exceedingly galling to the pioneer.

Roads, too, particularly in the neighbourhood of Cape Town, are often absurdly narrow, leading nowhere, if



ELEVATION.



PLAN.

Fig. 282.

so be that thereby another plot or two can be squeezed out of the area cut off. Owners when selling, in the past at any rate, not being compelled by law or "moral suasion" to make or pave them, or to lay sewer or water mains, they are too often mere dust-heaps in the summer and veritable quagmires or roaring torrents in the winter. The narrow roads, however, are discounted to a certain extent, owing to it being the usual custom to set the houses as far back from the street as possible, with the gardens in front and only a kitchen yard at the back.

From this short introduction it will be readily seen that the planning of the house of the ordinary man, the usual every-day problem, is attended with no small difficulty. In fact, one notices one or more of the following defects in nearly every house, namely, the best bedroom contiguous to the entrance door; the other bedrooms, and possibly the dining-room and study, with no other outlook but the boundary wall or fence a few feet away, and above that the upper part of the windows of the neighbouring house; long narrow airless passages; and the kitchen so arranged that the smell of cooking is almost more prominent at the front door than in the kitchen. These defects, of course, occur mostly in the one-storey house, which is still the most popular owing to the fact it is more easily worked, if necessary, without a servant or servants.

All houses, however, have a stoep or verandah, quite the most charming and useful feature in this climate, and a most necessary adjunct.

One may summarise briefly the principal points to be aimed at in planning a South African home as follows:—

1. Large, broad, and if possible continuous stoeps, with three aspects, so as to give shelter from the sun during all parts of the day on one side or the other.

2. Large airy rooms with natural cross ventilation wherever possible, and, in the case of living rooms, direct access to the stoep, or balcony, as the case may be.

3. Roomy hall and broad well-ventilated corridors.

4. Privacy of bedroom and bathroom accommodation, and good outlook to bedrooms.

5. Kitchen offices as much detached and cut off from remainder of house as possible.

6 Avoidance as far as possible of a western aspect to the more important rooms.

Lofty rooms are considered a great desideratum, but are not so necessary provided that the window heads are kept as near the ceiling as possible and the rooms well ventilated.

The houses illustrated in Figs. 282, 283, and 284 have been designed for restricted sites, and are all one-storey houses, and serve as types to illustrate the foregoing. That shown in Fig. 282 was designed for a site of a not altogether unusual size, namely, a plot and a half, the original plots being 40 feet wide. It was designed under instructions that the dining and drawing-rooms must face the front street (there being a street also at rear), a stoep on three sides of the house, and bedroom and other windows as far as possible not overlooking the neighbouring houses. The separation of the living rooms from the kitchen, by means of a wide and straight ventilating corridor, is noticeable, as is also the departmentalising of the bedrooms and the distinct bedroom accommodation for the coloured servant,—this last to the detriment of the kitchen, which, if not top lighted, would be dark and lack ventilation. The foundation

walls are of red brick, the walls above being rough-casted, with plain cement whitewashed verandah piers and walls. There is a slated roof with silver grey ridge and hip tiles. The half-timber work in gables is executed in jarrah.

The house shown generally in Fig. 283 (a large detail of the front being given in Fig. 284) was designed to fit the regulation 100 by 50 feet plot. The plan, although not altogether free from defects, is an improvement upon the type of house usually erected under such conditions. It was intended to be built of ordinary bricks with rough-cast tinted brown, and smooth plaster of a very light cream tint, and on a local hard roughly squared stone foundation. The stoep was to be paved with 3 inch local fine axed granite slabs, the half-timber work being of jarrah and the front door teak, with red English plain tiles for the roof covering.

Fig. 285 shows the plan of a house of a very usual size (mostly arranged semi-detached) on a plot of ground 40 by 80 feet, about the smallest subdivision made. In a house of this size and accommodation part of the passage-way is generally thrown into the dining-room, with access from the kitchen, etc., to the entrance door through it. This is strongly to be condemned, being a most inconvenient and uncomfortable arrangement, the extra space thrown into dining-room not compensating for the drawbacks. At the same time, neither is the ill lit and worse ventilated central passage way much to be commended; yet, as in Australia, it seems to be inevitable.

This is perhaps the smallest type of house the architect is called upon to design.

Owing to the scanty supply of good labour in the past, added to its expensiveness, and the lack of good material of almost every sort, the use of stock materials, such as doors, windows, architraves, skirtings, mouldings, etc., has become general, greatly to the hindrance of architectural development and style. In the past few years, however, a great improvement has taken place, and a more satisfactory standard attained, the result of more knowledge and better workmanship and materials; and consequently, particularly in the better class of houses, the architect's ideas are usually more satisfactorily and successfully carried out.

Materials in General Use.—Footings are usually of cement concrete, with perhaps a less proportion of cement than is used in Great Britain. Rising foundation walls are sometimes in concrete or brick built in cement, but more often of a hard local stone, most of which is beautiful in colour and texture, but too hard to be more than roughly squared. Presumably owing to climatic reasons, a bed of concrete over site is not required by the usual Municipal Bye-Laws or Building Regulations, and consequently is rarely used. Damp courses are usually of sheet asphalt of various qualities, while in cheap work a layer of tar and sand is sometimes used. For ordinary houses the walls are mostly of brick of very poor quality, built in clay or "dagga," *i.e.* the natural clayey soil common to most

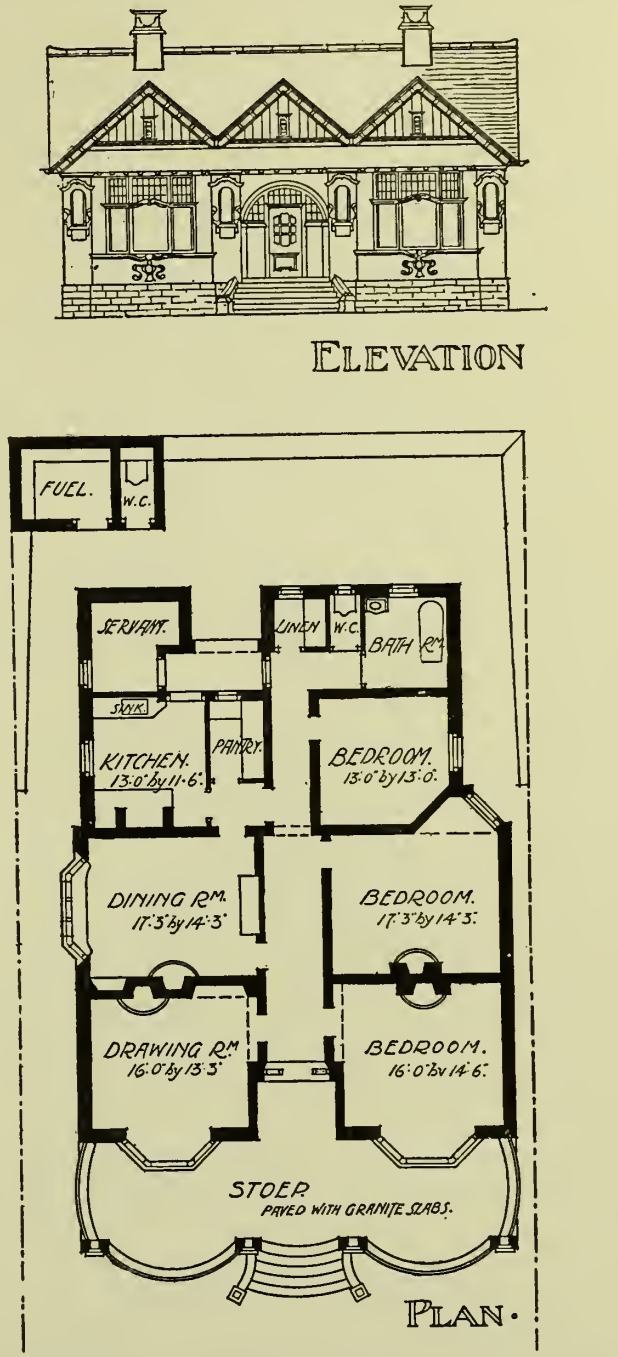


Fig. 283.

South African districts, no satisfactory lime being obtainable except in very few localities. In better class work cement mortar and hard burnt bricks are

used, the mortar often then being mixed with even as much as ten of sand to one of cement, and never less than five to one. All external faces of brickwork are cement plastered, either plain face or rough-cast, and are usually coloured afterwards. Now, however, that a better brick is obtainable in all but country districts, a little face brickwork is sometimes seen, but the bricks, although sound, hard, and well burnt, are rough and uneven, and much chipped at angles and edges, and a satisfactory result is not easily obtainable.

Ceilings are mostly match lined with ½-inch beaded and grooved and tongued boarding, either 6 or 4 inches wide. Steel stamped plates in various designs, imported usually from Canada, are also often used in the more important rooms, and so occasionally are ornamented and enriched fibrous plaster ceilings, the ordinary plaster ceiling and cornice being quite unknown.

Roofs are constructed usually of American Oregon pine in lighter scantlings, and spaced at greater

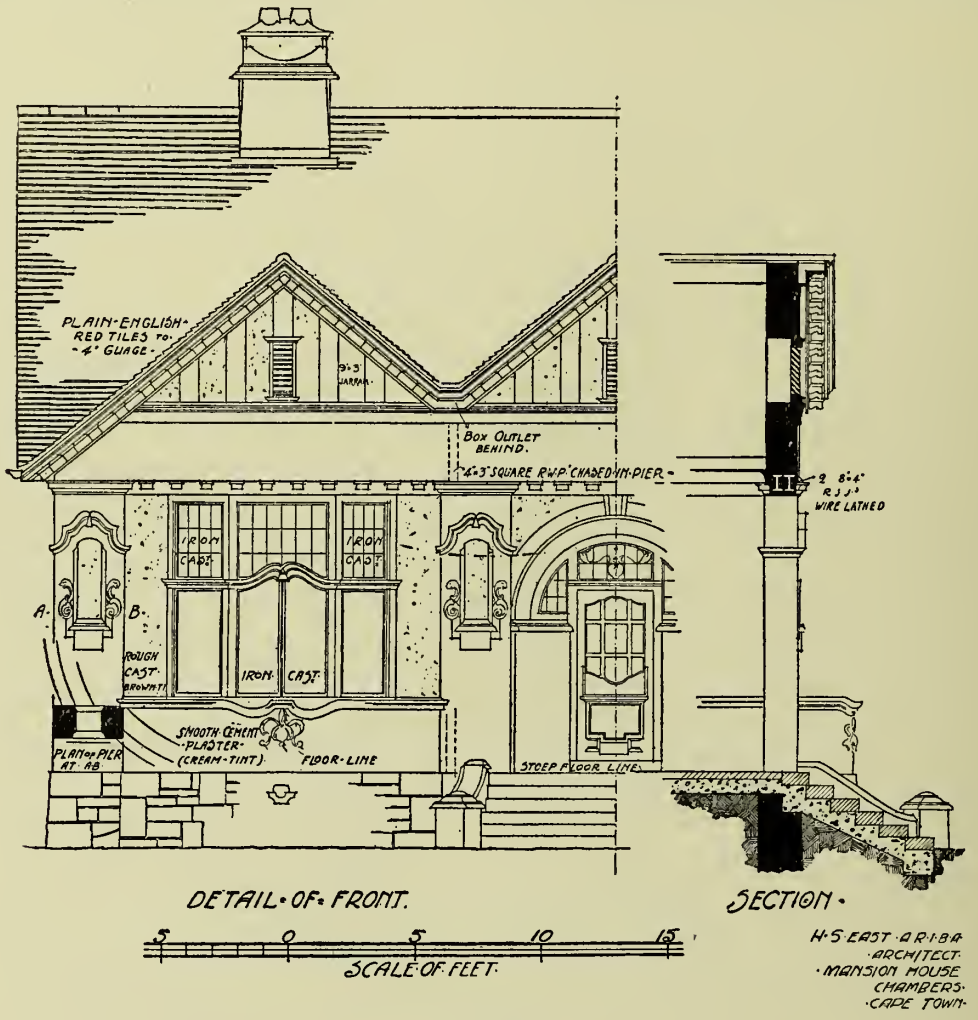


Fig. 284.

Partitions are usually of plaster slabs of various types, either built with smooth or rough faces, and skimmed after erection, lath and plaster scarcely ever being used owing to the poverty of the lime.

The internal plastering is of one or two-coat work; never more than two. In one-coat work, lime and sand in the proportion of one to two and stiffened with 10 per cent. of cement is usually used, although clay or dagga plaster is also much employed, particularly in the country districts. In two-coat work the ground is as before described, and the finishing coat is lime putty.

distances than is usual in England. In better work Swedish red deal is used. The covering most in use is corrugated galvanised iron, — perhaps the most unsightly roof covering ever invented, but satisfactory as regards keeping out the driving rain, and cool provided the ceilings are pugged with clay and straw.

Imported Marseilles or English plain tiles or Welsh slates are also used — tiles, whether Marseilles or English, usually being wired or nailed on battens without boarding or felt. Slates are nailed to boarding, and no battens are used.

Roof spaces should be, and almost invariably are,

ventilated by means of louvres placed either in gables or dormers.

The floors of rooms consist usually of 6-inch T. & G. imported deal flooring, and occasionally of narrow width pitch pine or maple. Kitchen and office floors are of cement or tiles, while the stoep is paved with cement, tile, or marble.

Joinery in the best houses is usually of teak—at any rate as regards exterior work; otherwise deal is used.

Kitchens are usually fitted with open Swedish, French, or English stoves; in most houses without any hot-water apparatus, but with subsidiary oil or gas stoves, baths being heated by geysers. Sanitary fittings are of the usual types, mostly of British make, and call for no special comment.

Ventilating gratings are usually inserted in walls of all rooms, as well as under floors.

The accompanying illustrations (Figs. 286–292) will perhaps serve to give a general idea of the style and character of the various types of the present-day South African houses, and have been carefully selected as more or less characteristic and typical of the trend of style or styles. In each and all of them some point or other of peculiar suitability to South African conditions of life and character will be found.

Generally speaking, they are houses giving a moderate amount of accommodation at a reasonable cost, although each individually, owing to the expensiveness of work and materials, would cost from 40 to 70 per cent. more than houses of a like amount of accommodation and appearance in the neighbourhood of London.

They are in most cases erected on suburban sites of sufficient area to allow of suitable and appropriate gardens.

In most if not all of them the question of native and white servants' accommodation has been carefully considered, and the question satisfactorily solved, a problem, too, of almost impossible solution in the smaller type of house, where one servant's room is usually provided, and that entered often from the yard.

The house shown in Fig. 286 is built on the estate lately acquired by the Duke of Westminster, from the designs of Messrs. Baker & Massey, at the now more or less historic place of Thaba'nchu, in the Orange River Colony, and is almost ideal in its studiously simple character and arrangement, the external and internal treatment being alike admirable. It has, moreover, the extreme merit of being thoroughly adapted to the climate and local conditions of the colony in which it is situated. The outer walls are built of local stone (freestone) of extreme beauty, the colour being a warm cream, and the roof is of imported Bridgewater tiles. The style of architecture is based on the Cape Dutch farmhouse of about one hundred or one hundred and fifty years ago, minus its more coarse and redundant features, and the house is almost monastic in its severity of treatment. Considerable departmentalising has been successfully attempted, especially with regard to the bedrooms, those for the coloured servants being admirably cut off from the rest of the house. The stoeps and galleries provide air and shade, while all parts are well lighted and communication is easy.

Fig. 287 shows a house of a different type, designed

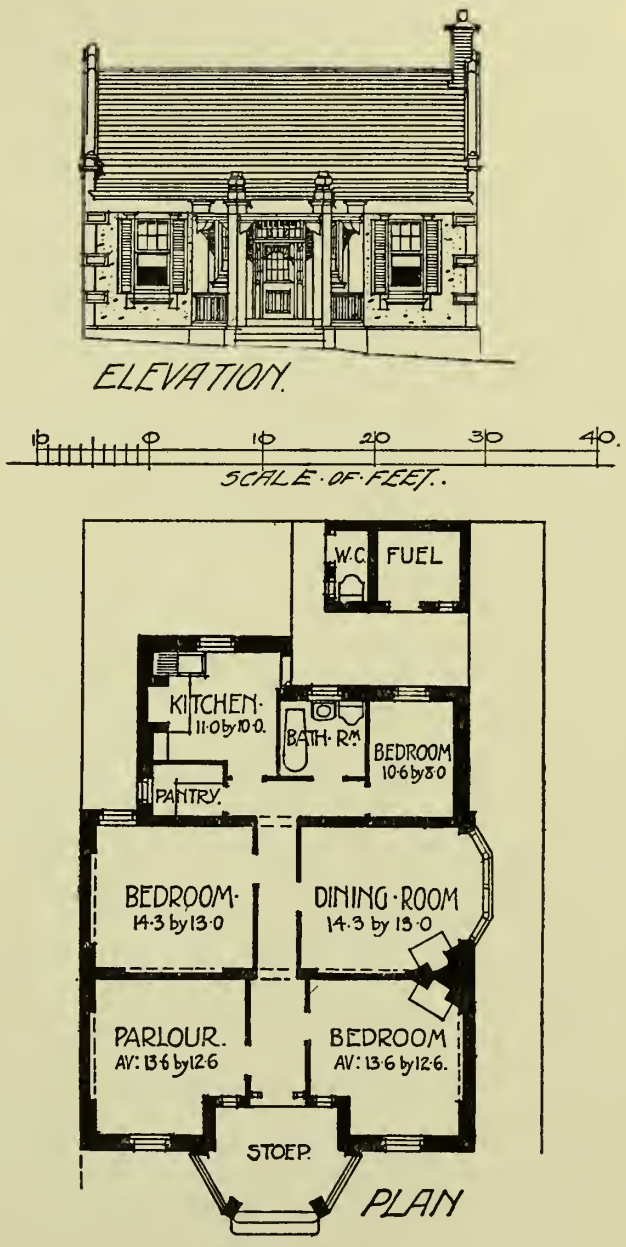
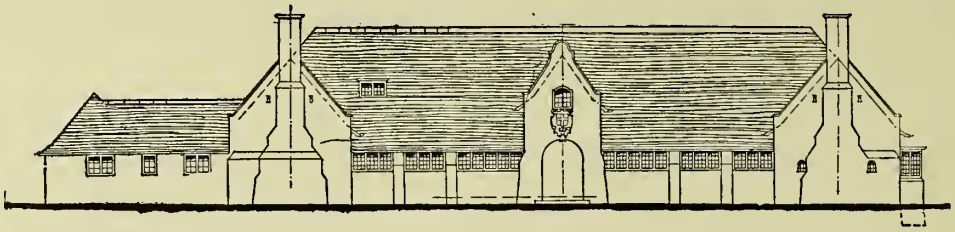


Fig. 285.

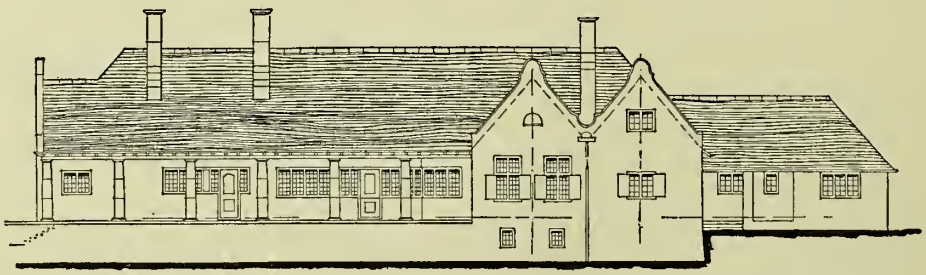
by Messrs. A. & W. Reid & East, situated in the seaside suburb of Cape Town, known as Sea Point. The site is a corner one, rather circumscribed, but with magnificent views over the sea and distant mountains of the Cape Peninsula to the north-east. The house was planned so as to obtain a view from as many of the rooms as possible, and at the same time to be sheltered

from the prevailing summer wind (S.E.), which rages with terrific violence at times on most of the coast towns. Dining and billiard-rooms were to be as large as possible, and only a small drawing or visitors' room was required, and few but large bedrooms.

The house was built in hard brickwork in cement, and finished in rough-cast and smooth plaster on a local pinky brown tinted stone foundation, the last being carried up to the coping of stoep dwarf wall and sill moulding of bay window, the chimneys, etc., being left



ENTRANCE FRONT.



GARDEN FRONT

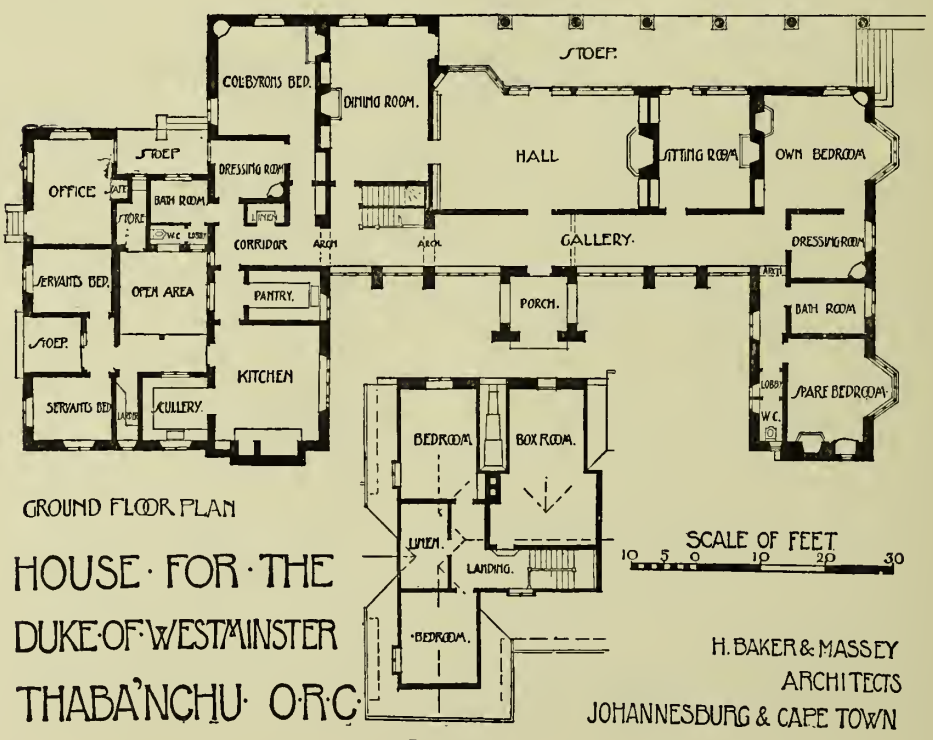
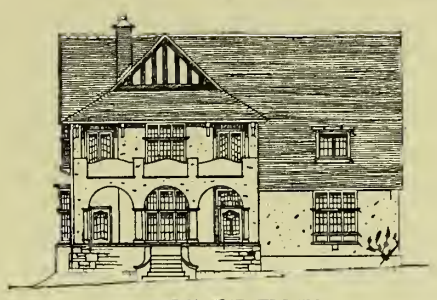


FIG. 286.

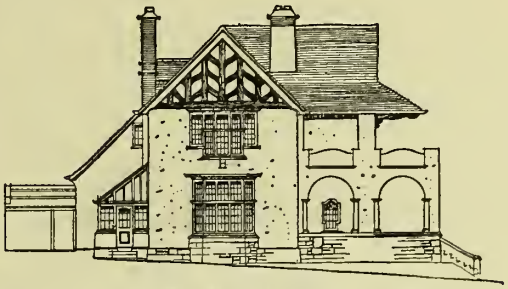
The stoep and balcony were to be as shady and cool as possible, while a special point was made of the aspect of, and right amount of sunlight to, the conservatory—a point often neglected in planning for this climate, as too much sun is undesirable.

unplastered with struck joints. For economic reasons the joinery throughout was of deal, except where hard wood was absolutely necessary. The windows are glazed with leaded light, some of which is rather of elaborate design, and well carried out locally. The

:SUBURBAN HOUSE · SEA POINT · CAPE TOWN:



:NORTH-WEST · FRONT:



:NORTH-EAST · FRONT:

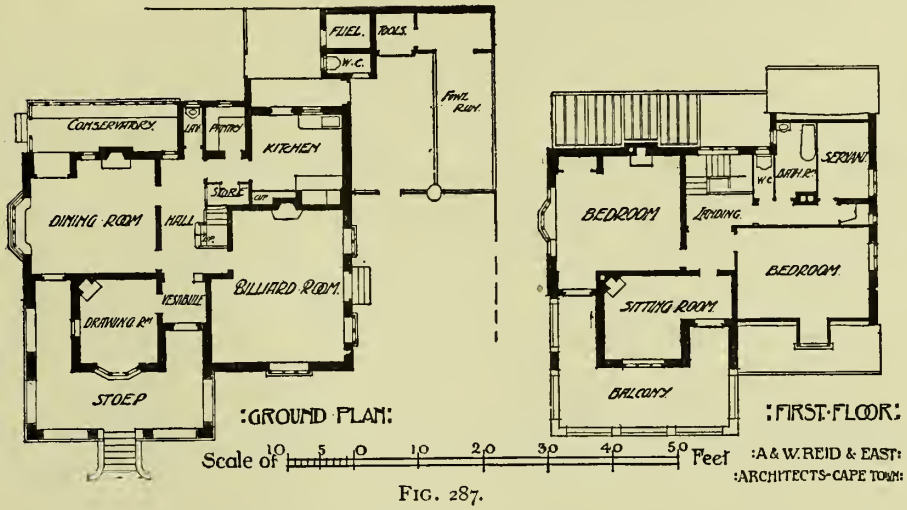


FIG. 287.

:SUBURBAN HOUSE-KENILWORTH-CAPE TOWN:

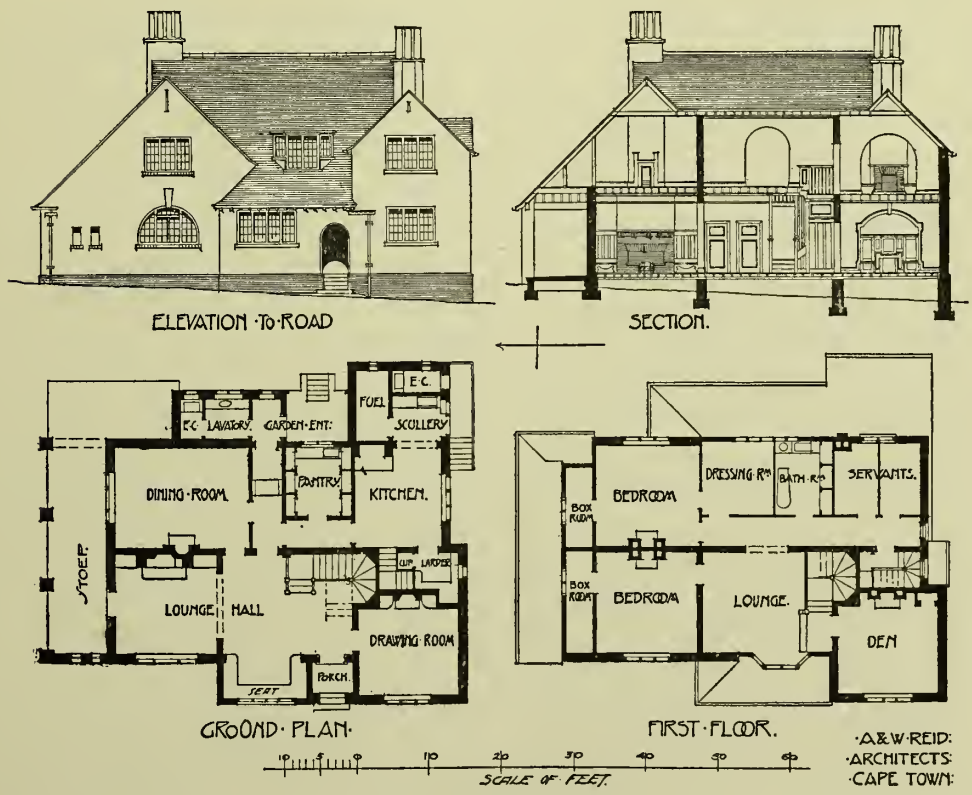


FIG. 288.

roofs are covered with very dark brindled Broseley tiles, and form a pleasing and effective contrast to the cream-and-white walls and surrounding fir trees and hill.

Stoep and steps are tiled, and the timberwork in gables and the supporting brackets to balcony over-

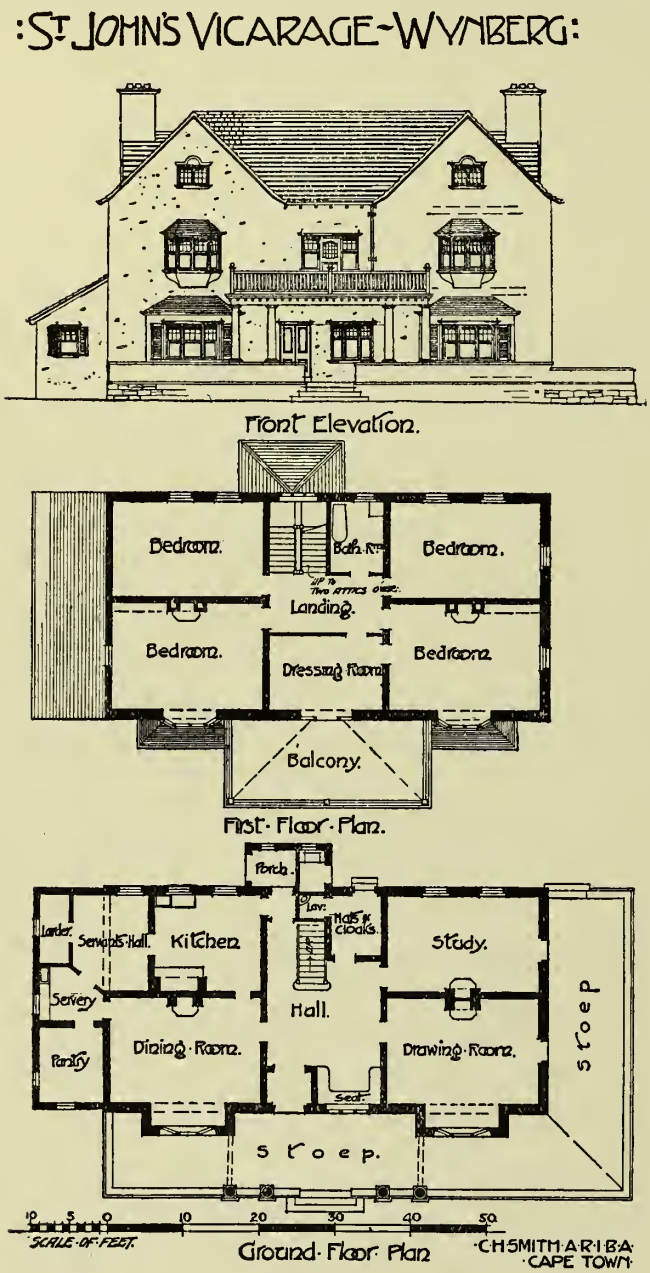


FIG. 289.

hanging roof are of sawn and shaped jarrah, left to weather naturally. Jarrah thus left tones to a beautiful silver grey, greatly resembling old oak, and at the same time losing nothing of its durability. Architecturally, it is obviously modelled on English lines adapted to local requirements.

The house shown in Fig. 288 is built on a lovely site at Kenilworth, a beautiful suburb situated 7 or 8 miles east of Cape Town, and might, as regards its exterior appearance, be mistaken for a small English country house. A study, however, of its internal arrangements and planning will reveal many points of difference, and show how suitable and appropriate it is climatically.

The plan is dominated by the lounge hall, a very successful feature both as regards pleasant home-life and architectural appearance, the interior views and vistas being very charming. The stoep was planned at the north end of house, in order to secure privacy and a very picturesque view of the Eastern spurs of Table Mountain.

The house is built of the usual materials, the external walls being finished in cream plaster on a red brick base. The roof tiles are of a bright red. The interior joinery is mostly of Californian red pine twice oiled, and is very effective in appearance. It was designed by Messrs. A. & W. Reid.

St. John's Vicarage, Wynberg, C.C., erected from the plans of Mr. C. H. Smith, A.R.I.B.A., is illustrated in Fig. 289. Although built for a vicarage, there is practically no difference in planning between this house and the necessary accommodation for an ordinary house of the same size. The planning is exceedingly simple and convenient, a feature being made of a large and for the most part uncovered stoep. As both Wynberg and Kenilworth, in common with the other suburbs on this side of Cape Town, had no drainage at the time when this was built (a system is being now installed), the sanitary accommodation both in this and the house just previously illustrated required special thought and arrangement.

The exterior treatment is very simple, but effective. The rough-cast here has also been finished cream, the shutters and other woodwork painted green. The roofs of main buildings are of Marseilles, and those of bay windows of English tiles.

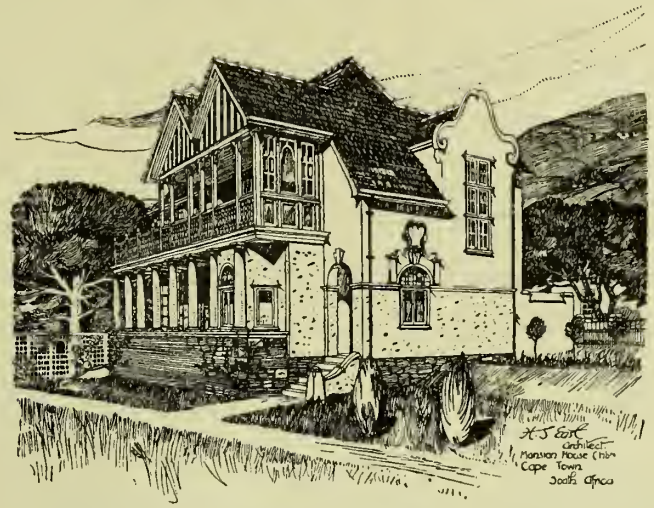
Fig. 290 illustrates a somewhat peculiarly planned house, which was the outcome (so far as plan goes) of the owner's personal views, based upon his long experience of the Cape climate, and represents more or less his ideas of a house suitable for a small family and local conditions, and his own personal tastes. Owing to a large tree in the grounds, which was not to be destroyed, shown to the left of the house in the perspective view, the entrance was rather more cramped than desired either by the owner or architect.

The large living room was designed for the various purposes of dining, drawing, and billiard-room, a small billiard table of about 8 by 4 feet being arranged for at the bay end of the room. The study was to be also used occasionally as a breakfast-room, and a room for callers when necessary. The stoep and balcony face north-west.

The exterior treatment is based upon both colonial and English precedent, and as the house faced three streets, and there is a fair amount of open space on the remaining side, there was to be no back in the usual acceptation of the term in South Africa. The materials

used do not vary at all from the usual, namely, rough and smooth-cast and brick and stone foundations. The rough-cast in this case has been coloured brown with a pink tinge, and the smooth-cast cream. The stoep

esquely designed, although perhaps it would gain by the rooms, etc., being somewhat enlarged. The bedrooms, being so much in the roof, are also not quite suitable to the semi-tropical heat of this part of the world. Apart



HOUSE AT SEA POINT CAPE TOWN

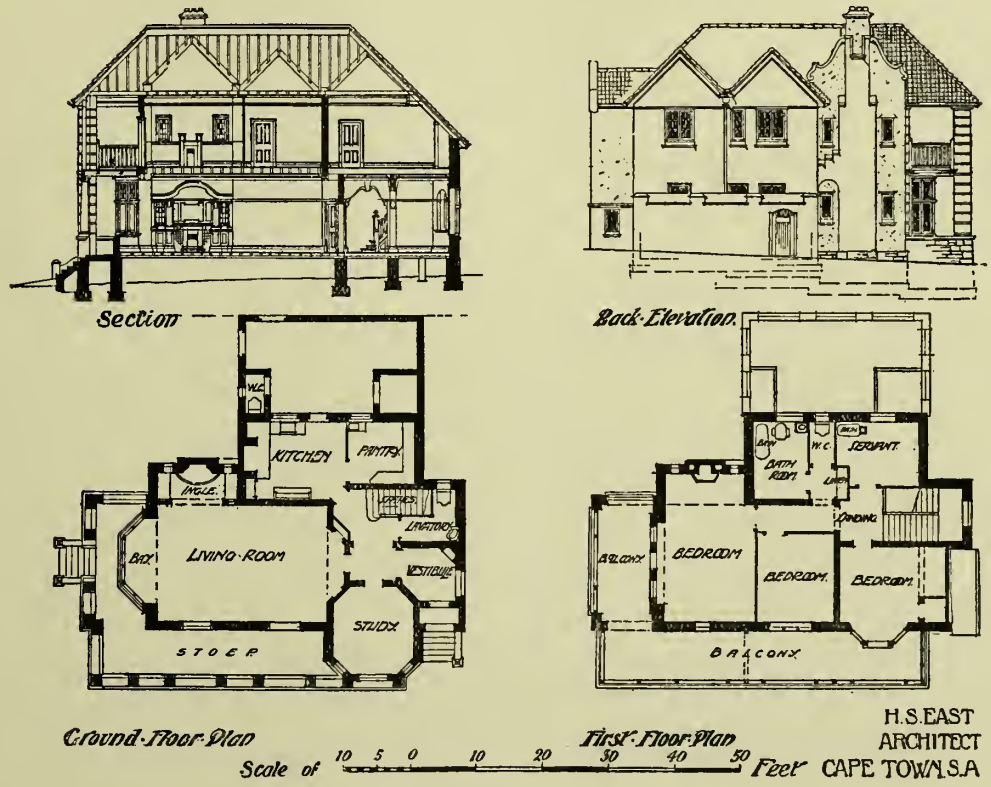


FIG. 290

columns are of cast cement, and the roof is covered with Marseilles tiles.

The house shown in Fig. 291, and designed by Mr. Stanley Hudson, is situated on the Berea, the principal suburb or residential portion of the town of Durban, Natal, and overlooks the town and harbour.

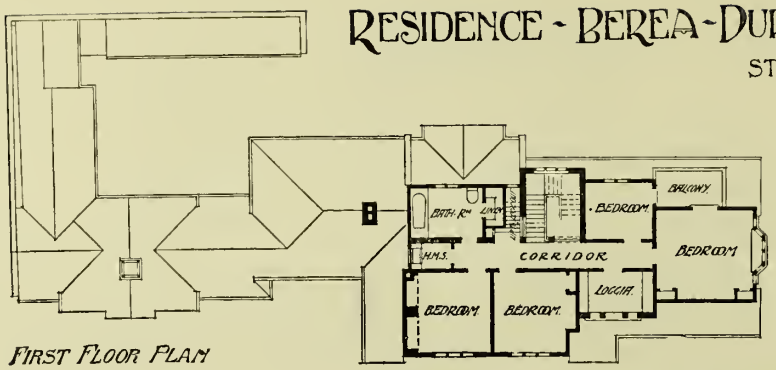
The building is very economically arranged and pictur-

however, from these objections, the house is as conveniently and comfortably arranged as any illustrated, whilst its picturesque appearance is beyond question both externally and internally. The quadrangular arrangement of the stable and the separate "boys" room will be noticed.

Fig. 292 shows the residence of Sir J. L. Hulett, quite

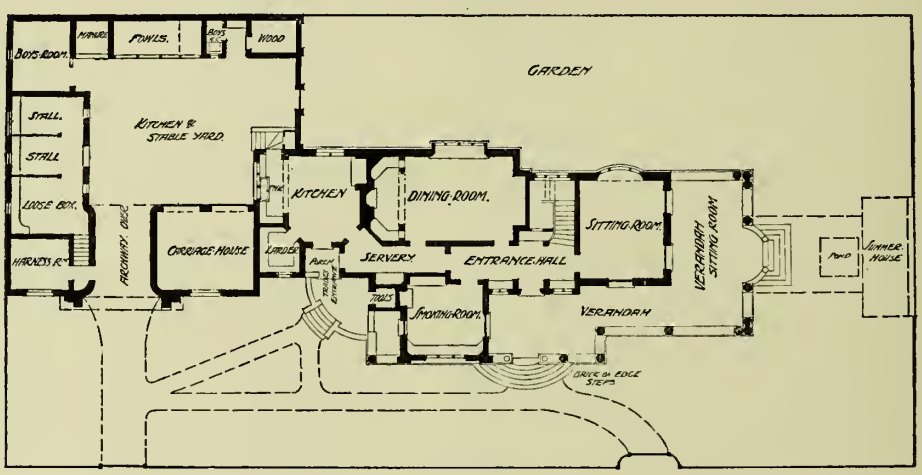
RESIDENCE - BEREA - DURBAN - S.A.

STANLEY HUDSON
ARCHITECT



FIRST FLOOR PLAN

ELEVATION TO 10TH AVENUE.



GROUND FLOOR PLAN

10TH AVENUE.

SCALE OF FEET.
10 5 0 10 20 30 40 50

FIG. 291.

the largest illustrated, and planned by Messrs. Stott & Kirkby on a somewhat grandiose scale. It is reminiscent of many Georgian houses both in England and America.

The building—now in course of erection—is situated on a magnificent site commanding a view of the Indian Ocean, and overlooking the Port of Durban on the one side and Mitchell Park and a range of hills on the other, with an open view all round. It is three storeys in height, with part basement, and, the roofs being flat, forms a promenade at the tower level, so arranged that standards can be fixed over any or all of the roofs to support awnings.

The plan is cleverly arranged to obtain very wide stoeps and open-air loggia spaces, without any loss of light in the various rooms through the windows being set too far back.

The decorations to the various rooms are receiving special attention, a great feature being made of the two-storey hall, which is fitted with an elaborately designed teak staircase. The hall floor is of parquetry (specially imported from England), and the walls are lined with teak panelling, with teak half timberwork in the ceiling and upper portions of the hall. The whole of the fittings and furniture of the library, including the mantelpiece, panelling, book-shelves, tables, etc., are also being executed in teak.

The steps leading to the porté-cochère, to the entrance porch, and the semicircular portico are in white Sicilian marble, and all loggias and verandahs, etc., are laid with superior glazed tiles. The whole of the kitchen quarters are similarly tiled, the walls having tiled dados.

The fittings to the kitchen, scullery, pantry, wash-house, and servery consist of marble slabs, and the other fittings throughout the building are in keeping with a residence of this character and magnitude.

Many of the houses here illustrated have stabling, etc., connected with them, but the arrangements and details of same differ so slightly from buildings of this nature elsewhere that, except in one instance (Fig. 291), where the stabling and outhouses form an integral part of the design, it has not been thought necessary to reproduce them.

Although the accompanying illustrations show houses more or less suitable and satisfactory, taking into consideration local requirements, yet conditions differ so much, even in towns situated but a few hundred miles from each other, that it is impossible without several years' experience of South Africa for any architect to successfully design and carry out houses thoroughly suitable and adapted to all needs.

The author has had several opportunities of studying plans, working drawings, and details of houses designed by British architects for South Africa. In the best, although the defects and differences may seem but small to the outside eye, they (the defects) are often of such a character as to nullify many excellent points in the plans and design. In the worst the houses are but travesties of what a South African house should be.

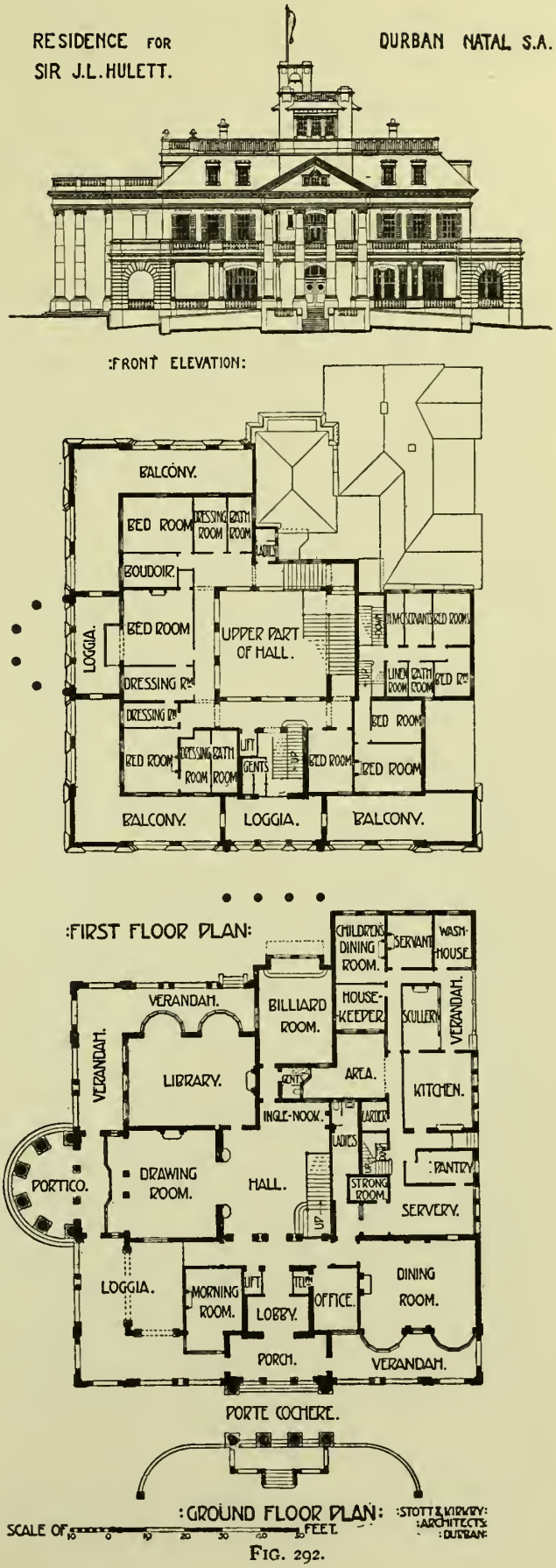


FIG. 292.

CHAPTER II

SHOPS, OFFICES, AND OTHER TOWN BUILDINGS

(Contributed by H. S. East, A.R.I.B.A.)

The exigencies of climate and local influences, material, etc., do not affect the planning and arrangements of shop, office, and other town buildings to any great extent.

In most cases the ground floors of buildings, and in some cases the first floors also, are protected from the sun and weather by verandahs and balconies carried over the pavements, and supported by columns at the edge of the curb. This protection is a boon to pedestrians alike in wet and fine weather. Besides this, care must also be taken to protect windows facing north and west from the heat of the sun with louvred shutters, venetian blinds, sun-blinds, or other means, of which, in spite of their limitations as regards design, louvred shutters are the most satisfactory from the practical point of view.

Owing to the powerful light and clear atmosphere, internal light areas are much smaller in size in proportion to those necessary to obtain sufficient light in England. The principle, though, is very often carried to excess, and many of the lately erected high buildings are entirely spoiled by introducing more offices than could be effectively built upon the site, and by non-calculations of angles of light. A safe working principle to go upon is to allow the walls of an area or areas to be built two to three times their width, this height being calculated from the sills of lowest windows.

All buildings over four storeys in height should have a fire-escape staircase satisfactorily and conveniently arranged; in fact, in Johannesburg and in some other towns these stairs are insisted upon.

Lifts are a necessity in any building of such height or higher, and two at least are advisable in any block of over, say, 6000 feet super. and more in proportion. They are usually electrically worked.

In Cape Town and Cape Colony towns generally, sites are usually of no given sizes, but Johannesburg and other towns laid out in very recent times have been cut up into blocks or stands of 50 by 100 feet, occasionally subdivided again at corners into 56 by 50 feet. This, whilst ensuring uniformity of frontage to a certain extent, has the great demerit of being a very awkward size to treat architecturally, unless the building is very high or rather low.

As, however, the average height of office, store, and shop buildings generally is about 60 feet plus basement, it will readily be seen that, except on the longer frontages, good proportions are not easily obtainable, and the square box form difficult to get away from.

The larger stores and emporiums with showrooms, etc., display very little grasp of their business requirements as regards planning, and have mostly been built piecemeal as the business extended, and without much regard for the safety, convenience, and comfort of their customers. Of course, some of the later erections of Johannesburg and elsewhere are exceptions to this rule, and are as up-to-date as possible in all ways.

Owing to some towns (including Johannesburg) not having a sewage system up to the present, all sanitary conveniences in these towns have had to be planned apart from the main block of buildings, and a sanitary passage (usually about 3 feet wide) arranged for from the street, with open-air stairways up to the various latrines for emptying purposes. In such cases these stairway sand passages are usually utilised also for fire-escape purposes.

A reference to several Johannesburg buildings hereafter illustrated will show how much this question has to be studied, and how difficult in many cases the problem is. As, however, most of these towns, Johannesburg included, are installing a water-borne sewage system, the problem will gradually disappear.

Chambers or flats are not numerous in most towns, although at Johannesburg there is perhaps rather a plethora of them at the present. They are usually arranged either as single rooms or in suites of two or three rooms, each set having its own bathroom. Generally speaking, in these blocks one or more of the ground floor shops is arranged as a restaurant, where occupants can arrange to have their meals at more or less reasonable prices on a monthly tariff.

In many parts of South Africa fireplaces or other means of heating are unnecessary. Where the climate or conditions make artificial heat at times desirable it is accomplished by means of fireplaces or low-pressure hot-water pipes with radiators on the usual systems, differing not at all from the European types, but perhaps not always so efficiently carried out.

Of late years the tendency in South Africa in town buildings has been towards the American "sky-scraper" type mostly, kept down to a reasonable height. In nearly all cases skeleton steel framing has been used,

SOUTH AFRICAN MUTUAL LIFE ASSURANCE BUILDINGS PORT ELIZABETH

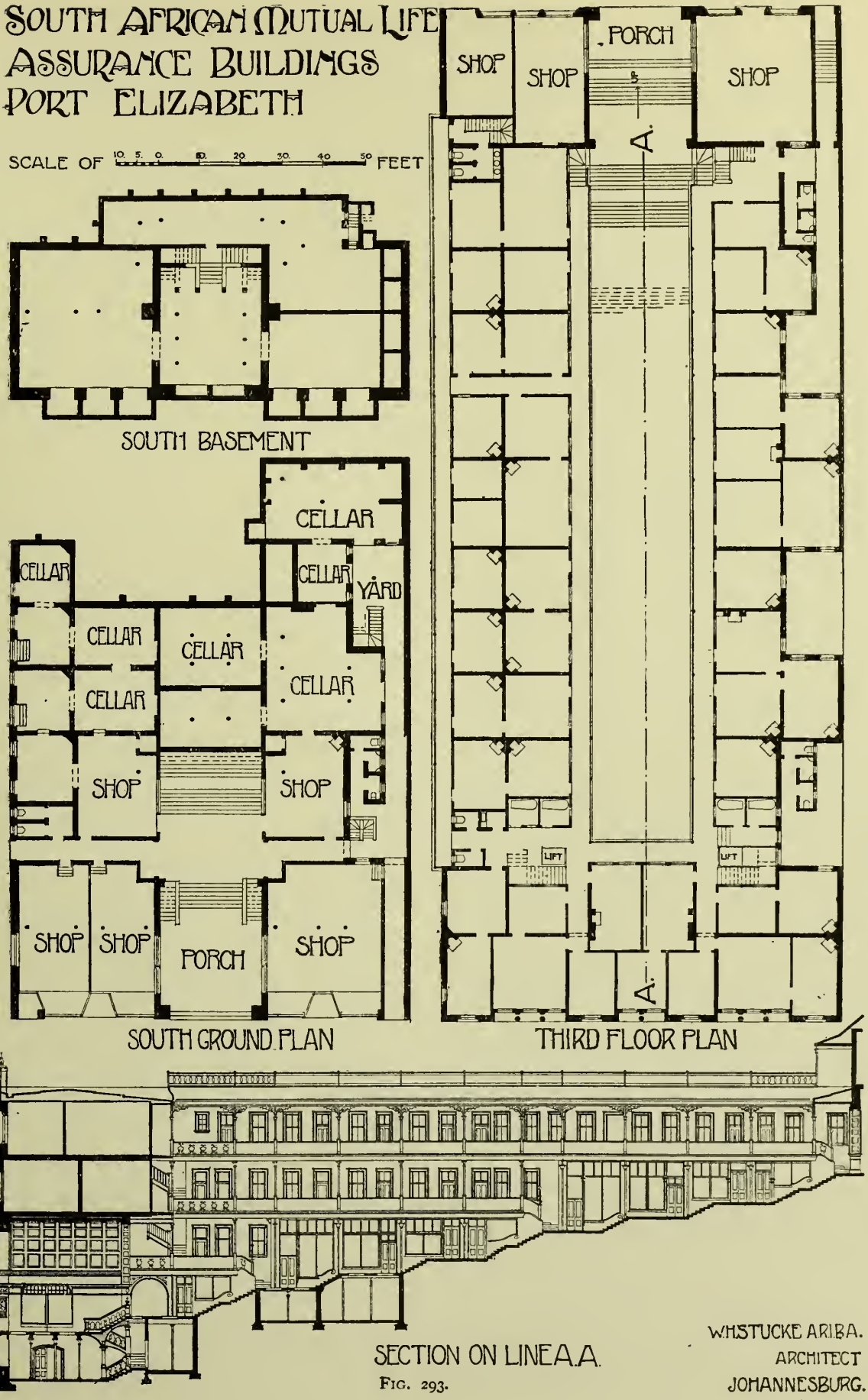


FIG. 293.

W.H. STUCKE A.R.I.B.A.
ARCHITECT
JOHANNESBURG.

without, however, in many cases sufficiently efficient protection of stanchions and girders from fire by means of concrete or other suitable material.

Building being costly and high rate of interest a primary factor, the fronts are usually in brick cemented, this last being often coursed to imitate stone. Still, a goodly proportion of stone and terra-cotta fronts can

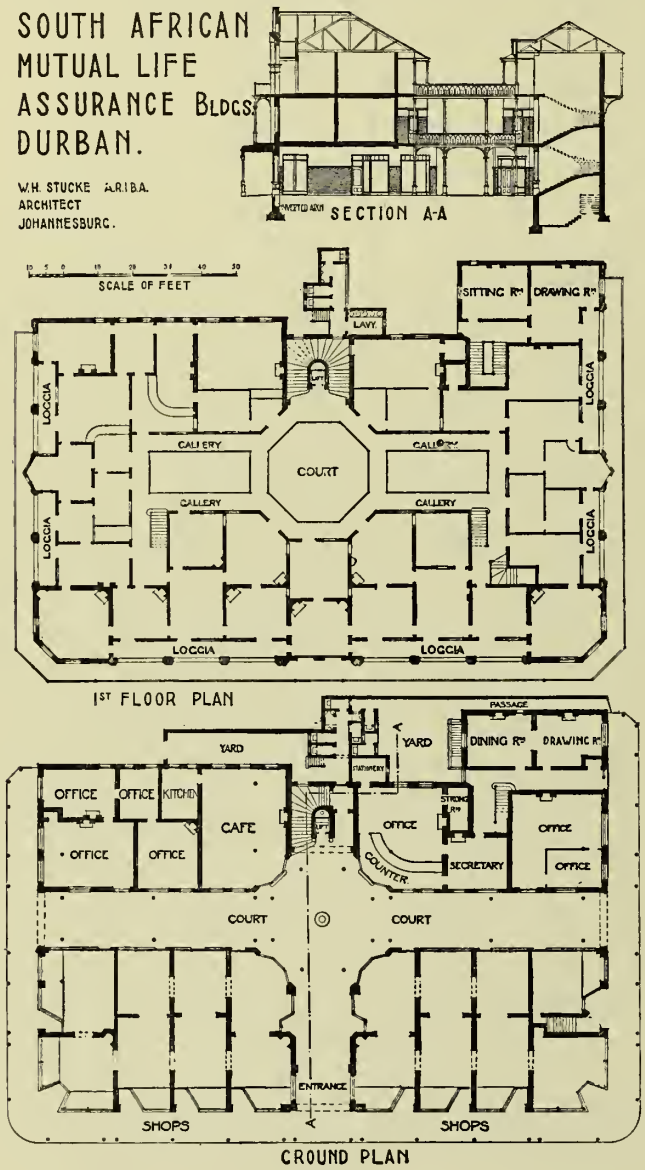


Fig. 294.

be seen, looking perhaps the more effective for their grey surroundings.

Shop fronts and fittings are mostly imported from England, and designed, not by the architects, but by well-known shop-fitting firms. They therefore differ not at all from the usual type to be seen everywhere during a ramble round London, except that the carving and scrolls, etc., are even more incongruous and out of place in this dusty climate. There are distinct signs of a change in this direction, and the author knows of at least one long range of shop fronts which have been constructed locally, and from designs and details supplied by the architect.

The treatment of street verandahs and balconies in the past has been anything but satisfactory, but more uniformity of proportion is now probable, owing to the local building regulations being more definite as regards heights and sizes of columns, fascias, cornices, etc.

In one or two of the office buildings illustrated a development of office planning peculiarly adapted to the local conditions and climate will be noticed, namely, the central open court, with covered corridors round it, from which the various offices and rooms are entered. There is no question that this is a very suitable and appropriate arrangement, and capable of charming achitectural treatment at small expense.

Fig. 293, for instance, illustrates the South African Mutual Buildings, Port Elizabeth, C.C., designed by Mr. W. H. Stucke, A.R.I.B.A., which is a large block of buildings cleverly planned on an awkwardly steep site, and arranged for offices, shops, and cellars, and a large café in the basement. A reference to the section will enable readers to fully understand the plans, and appreciate the manner in which the various flights of steps are arranged to make the way through as easy as possible. The arcade being only partly covered over, makes for coolness without excessive dust in the high winds. The sanitary passage previously referred to will be noticed on the right or east side of the south ground plan.

On the third floor four bathrooms are planned for use in the event of certain rooms being let as chambers or suites of living rooms.

The exterior has not been illustrated as, although massive and dignified, it is not nearly so interesting or worthy of study as the admirable interior arrangements.

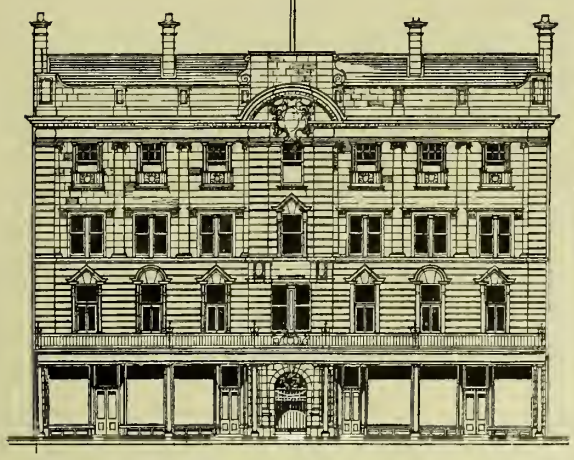
Fig. 294 shows the South African Mutual Buildings, Durban, Natal. These are very similar in treatment and admirably arranged, the very utmost being made of the space at disposal without any sacrifice of convenience and light and air. Perhaps a little more sanitary accommodation would have been advisable, and the awkward entrance to the lavatories should have been avoided.

Great care has been taken to keep as many windows as possible away from the direct sunlight. The shallow loggias shown, by means of which this is effected, give much more play of light and shade externally than is usually possible.

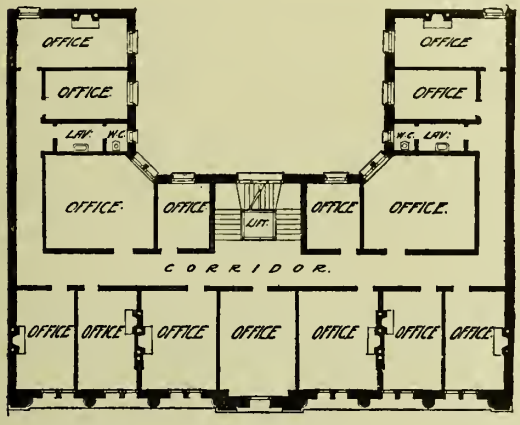
The Southern Life Assurance Company's Branch Building, Bloemfontein, O.R.C., designed by Messrs. Parker & Forsyth, of Cape Town, is illustrated in Fig. 295. The building has been erected mostly as an investment for the company's funds, and the company's offices occupy but a small portion of the first floor, the ground and remaining floors being arranged entirely for letting purposes.

The general arrangement of plan is simple and calls

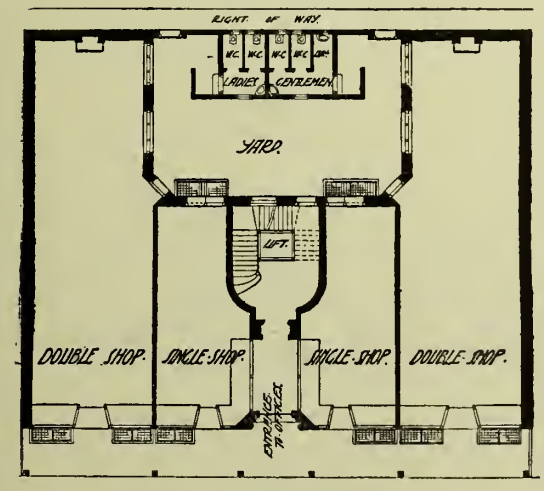
SOUTHERN LIFE ASSURANCE COY.
BRANCH OFFICE. BLOEMFONTEIN. ORC.



: FRONT ELEVATION :



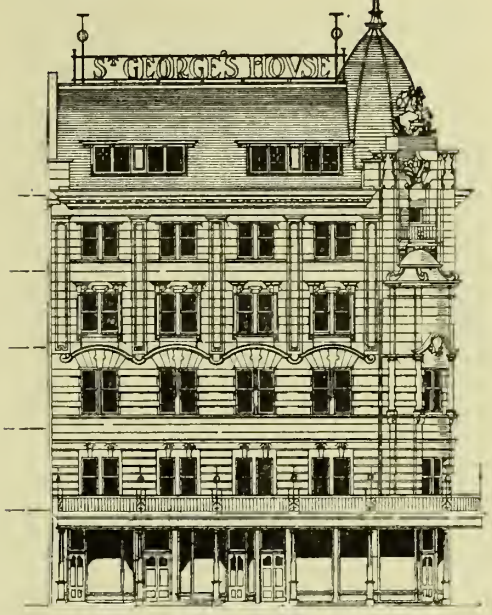
SECOND FLOOR PLAN.



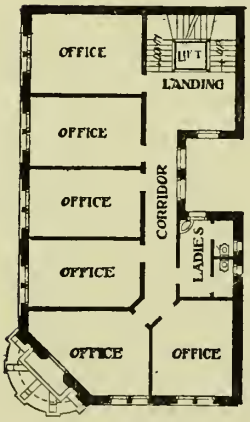
GROUND FLOOR.

Fig. 295.

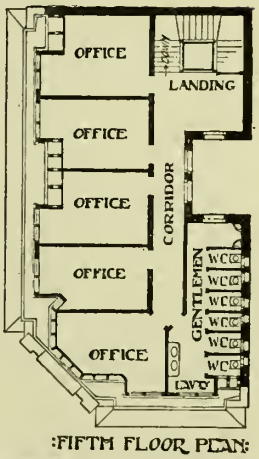
: BLOCK OF OFFICES :
: CAPE TOWN :



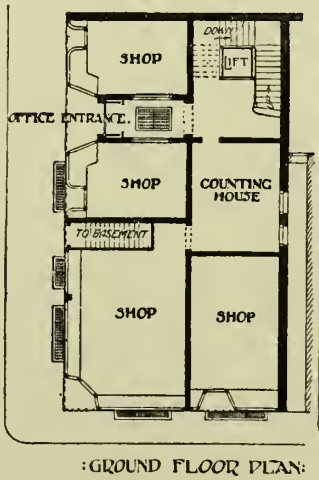
: ELEVATION TO ST GEORGE'S ST :



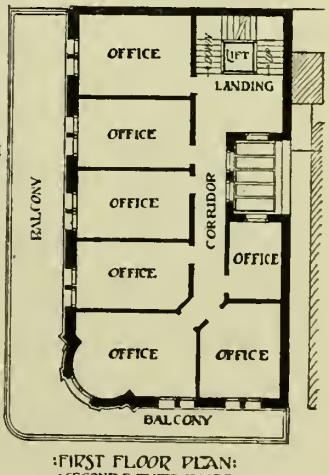
: FOURTH FLOOR PLAN :



: FIFTH FLOOR PLAN :



: GROUND FLOOR PLAN :



: FIRST FLOOR PLAN :
: SECOND & THIRD SIMILAR :

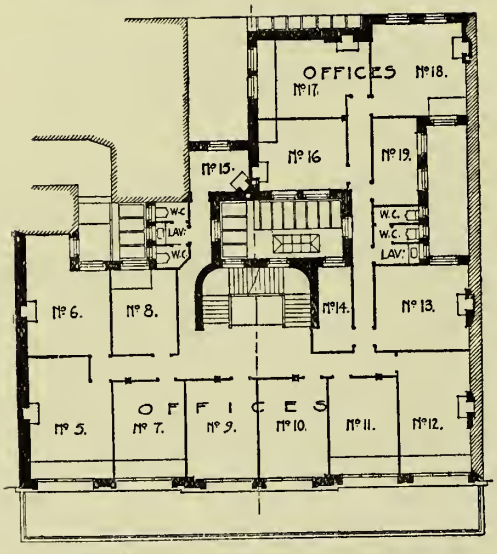
SCALE OF FEET —
10 5 0 10 20 30 40 50

: PARKER & FORSYTH :
: ARCHITECTS :
: CAPE TOWN :

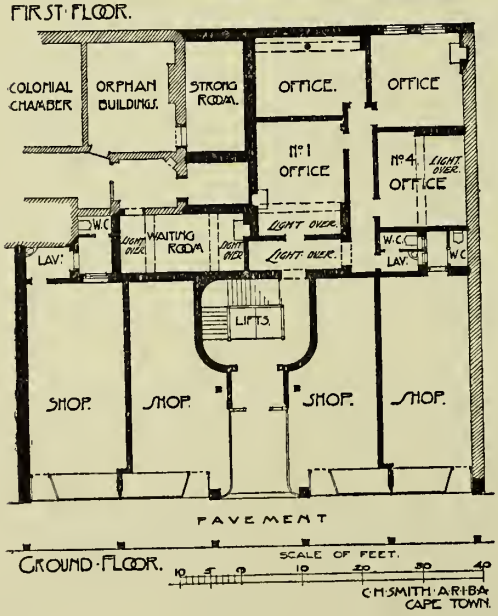
Fig. 296.

CARLTON BUILDINGS CAPE TOWN

ELEVATION.



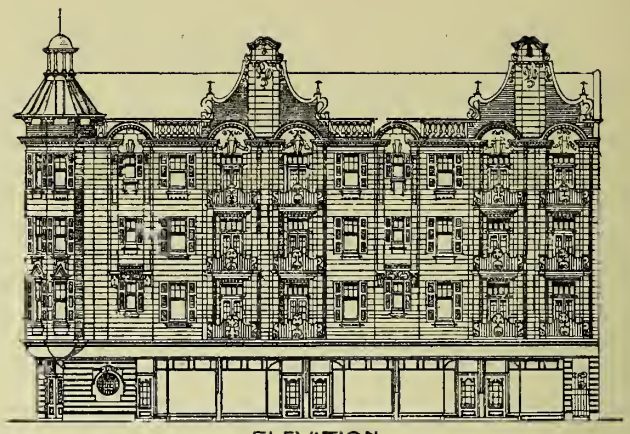
FIRST FLOOR.



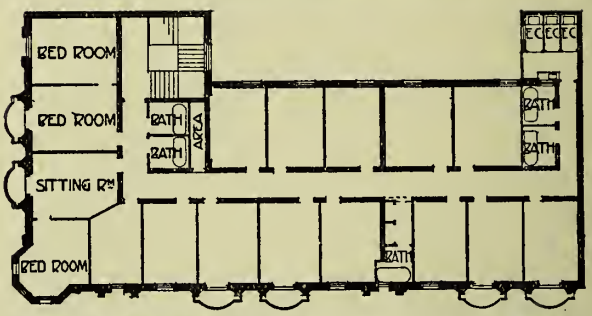
GROUND FLOOR.

C.H. SMITH A.R.I.B.A.
CAPE TOWN.

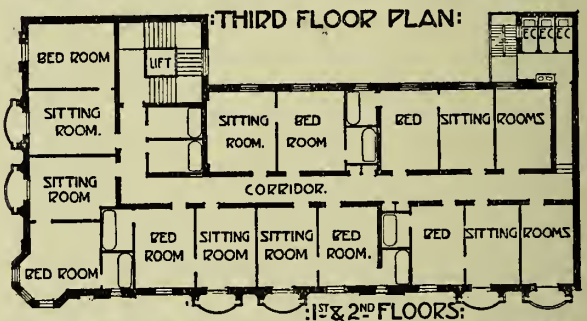
FIG. 297.



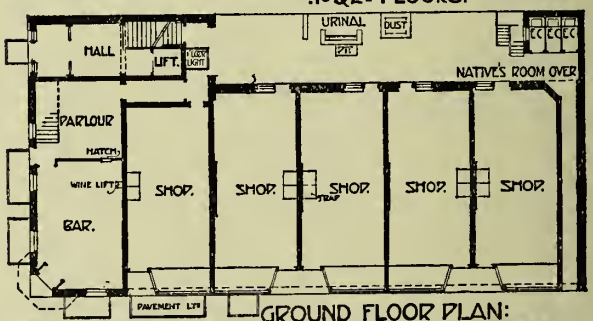
:ELEVATION:



:THIRD FLOOR PLAN:



:1ST & 2ND FLOORS:



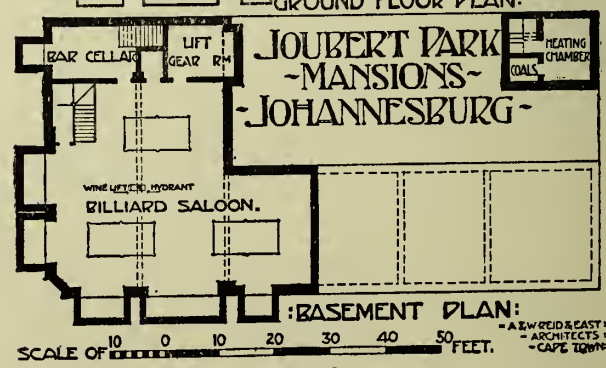
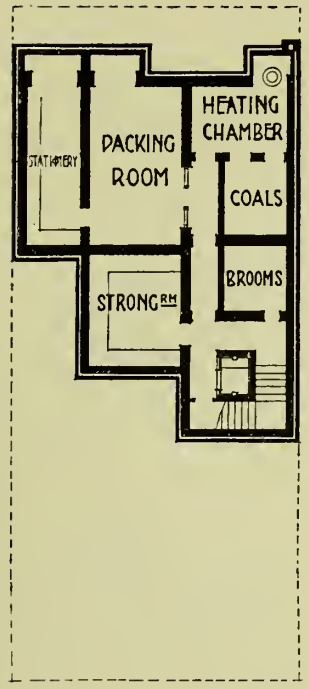
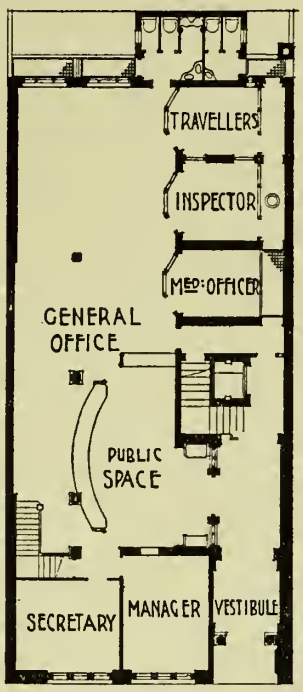


FIG. 298.

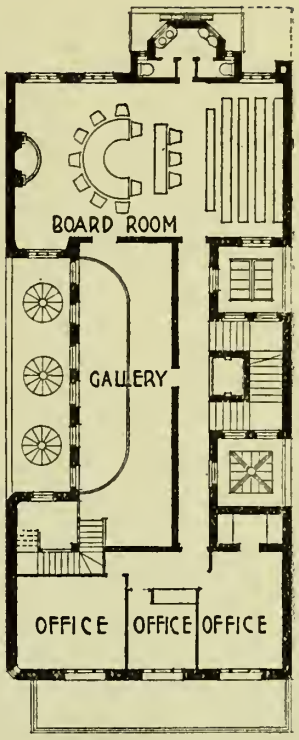
BLOCK OF OFFICES CAPE TOWN S.A.



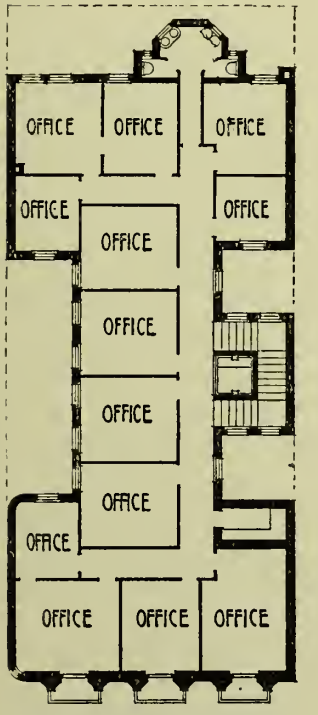
BASEMENT PLAN



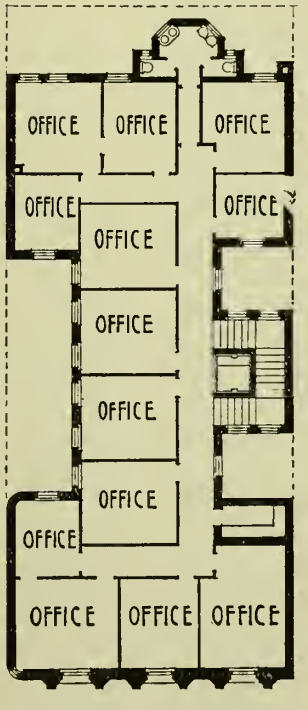
GROUND FLOOR PLAN



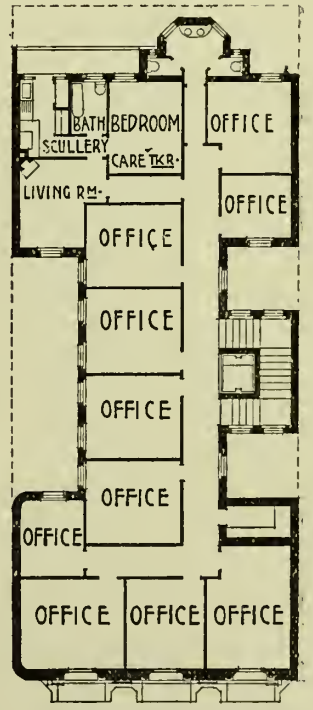
FIRST FLOOR PLAN



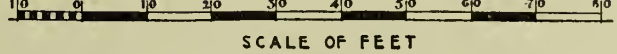
SECOND FLOOR PLAN



THIRD FLOOR PLAN



FOURTH FLOOR PLAN



SCALE OF FEET

FIG. 299.

for no comment, the first and second floors being similar in arrangement, except that the central part of first floor at front is occupied by the company; and the third floor is arranged in suites of small flats of two rooms each, the end wings at back containing bathroom and w.c. accommodation.

The front is built of freestone, a good stone being obtainable in many parts of the Orange River Colony, the front slope of roof being covered with green slates.

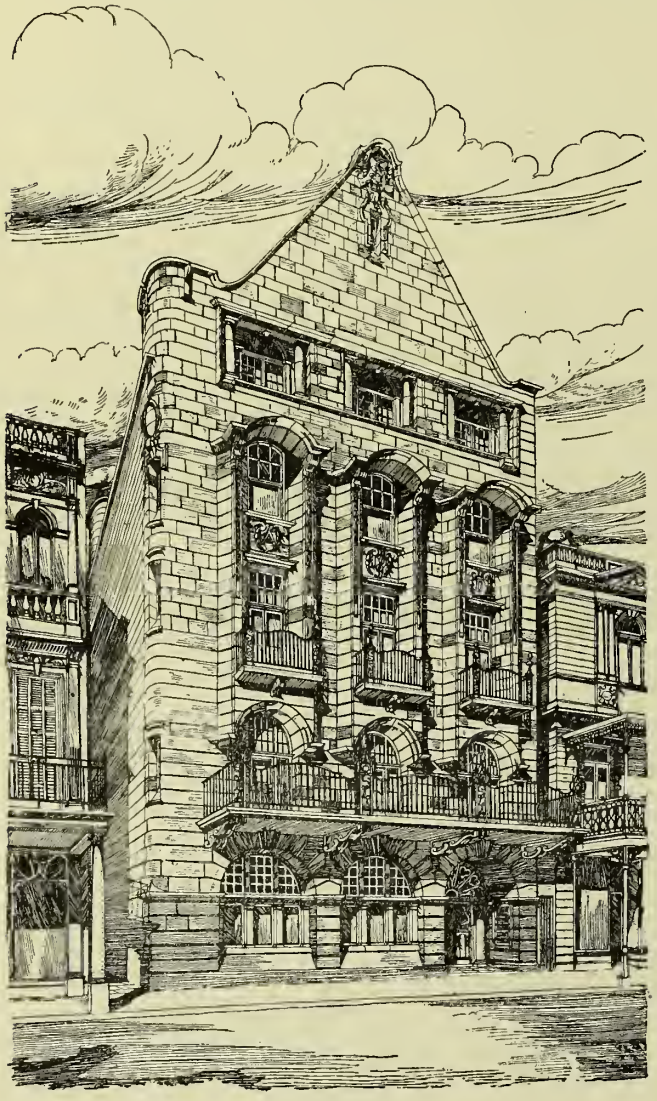


Fig 300.

A small block of offices and shops, erected from the plans of the same architects on a somewhat cramped and narrow site in the centre of Cape Town, is shown in Fig. 296. The ground has been well utilised and the utmost possible accommodation provided ; as will be seen, all the lavatory accommodation has been arranged on the two upper floors.

The exterior, although only executed in brickwork cemented and coloured, is very effective, the detail being particularly refined and pleasing and suitable to the material. The roofs in sight are covered with dark red English tiles.

Fig. 297 shows Carlton Buildings, Cape Town, designed by Mr. C. H. Smith, A.R.I.B.A.

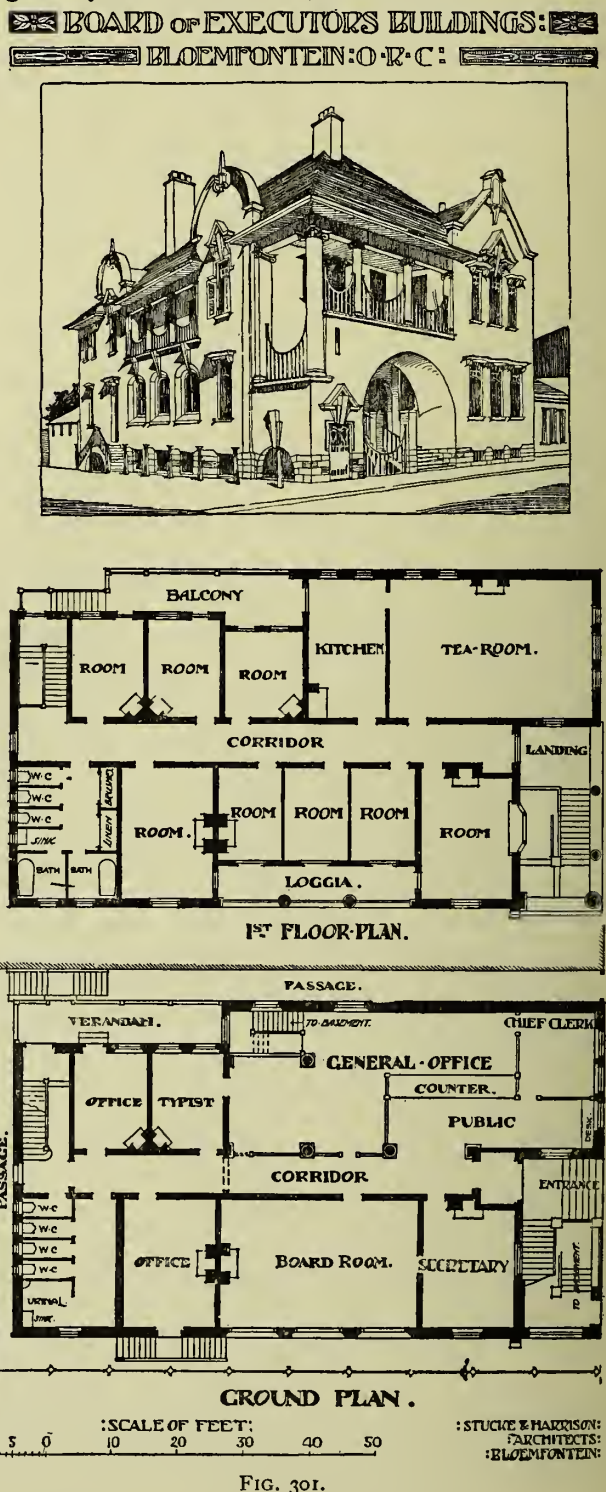


Fig. 301.

The site is somewhat irregular, and the planning complicated by additional accommodation having to be provided for the Colonial Orphan Chambers existing buildings.

A somewhat remarkable point about the building is, that although it appears and is only one block, it is under a dual ownership, a dotted dividing line on the first-floor plan showing the division. The awkward site has necessitated the use of a considerable amount of girder and stanchion work, and has made the lighting problem somewhat difficult.

The front is built of local mountain stone with red Dumfries dressings. The roof and hoods over first-floor windows are tiled, and all the windows, shop fronts, doors, etc., are in teak.

Fig. 298 shows the Joubert Park Mansions, Johannesburg, designed by Messrs. A. & W. Reid & East.

This block is situated on a fine site in Johannesburg, overlooking Joubert Park, and is rather a good example of the small blocks of flats of which Johannesburg contains more than are necessary for its present population.

The ground floor, except for entrance hall, stairs, and lift to flats, and the necessary light area and sanitary passage, is entirely taken up with shops and bar, each shop having ample cellarage under, while the bar has a large billiard saloon in the basement.

Each suite of rooms has its own bathroom, in most cases entered direct from bedroom, and the arrangements generally are well adapted to the needs of that considerable portion of the inhabitants of Johannesburg who "board" at convenient restaurants on monthly terms, and only require living and sleeping accommodation.

The fronts are finished in cement as usual and whitened, the face brickwork in gables being a rather bright red finished with struck joints.

Fig. 299 shows a scheme for a rather narrow and deep site in Cape Town. In the planning, advantage was taken of all the neighbouring areas and a narrow right of way at left of site to the benefit both of the proprietors and surrounding owners.

The ground, basement, and part of first floor were arranged for the use of a large insurance company, the remainder of building either letting singly as offices or as suites with resident caretakers' quarters on the fourth floor. By carrying up part of the ground floor general office, extra clerking space was obtained, easily supervised, and good ventilation and lighting to main office was assured.

The front (Fig. 300) was designed for stone used in two colours in broad masses of light grey and cream on a dark grey unpolished granite base (carried up to transom of ground-floor door and windows), and all the joinery is of hard wood of various kinds.

The window openings were in all cases as deeply recessed as possible, as shutters or sun-blinds were not desired.

Fig. 301 shows the Board of Executors Buildings, Bloemfontein, O.R.C., designed by Messrs. Stucke & Harrison. This little building has a very picturesque appearance, the external staircase being an effective feature and grouping well with the loggia on the other frontage. The ground floor is entirely occupied by the offices, etc., of the Board of Executors, the first floor being utilised for offices, together with a tearoom and kitchen, etc., appertaining thereto.

The premises of the National Bank of South Africa, Bloemfontein, O.R.C., shown in Fig. 302, have been erected on an important corner site in Bloemfontein, from the designs of Messrs. A. & W. Reid, and afford accommodation for about ten clerks, besides manager, accountant, etc. The shop at side of the banking chamber is so arranged that it can at any time be thrown into the bank for an increased clerical staff.

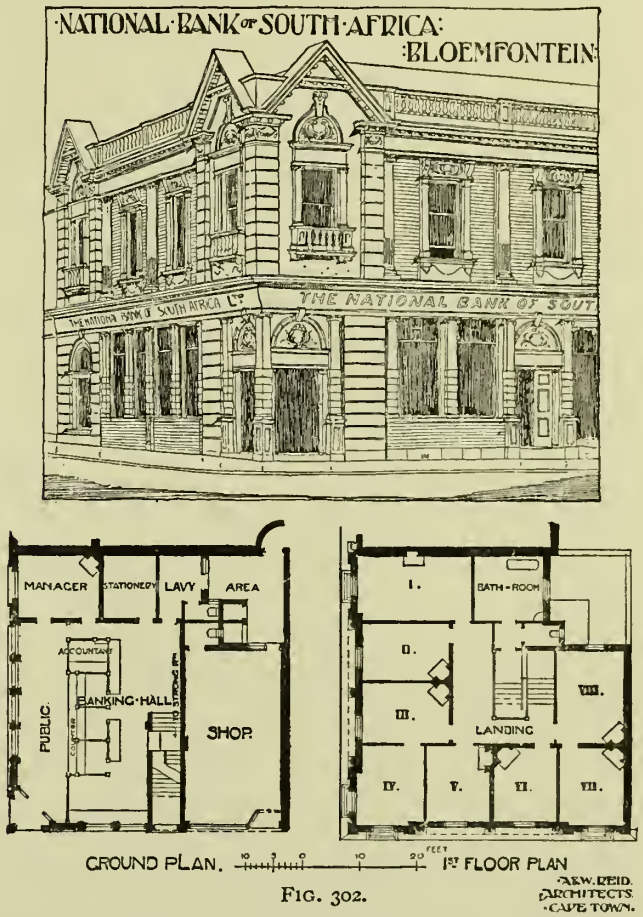


FIG. 302.

The banking chamber has accommodation for two tellers and a bill clerk in separate compartments, and the accountant's office has been so placed on a higher level that he can command the whole of the counter and staff, the cage compartment system, common on the European continent, being used in preference to the English open counter.

Part of the basement is utilised as a strong-room, approached by a fireproof staircase, whilst a hand lift is provided for conveyance of books, etc., to and from the strong-room.

The first floor rooms are used as bedrooms for the staff, and are provided with lavatory and bath accommodation.

CHAPTER III

SCHOOLS

(*Contributed by H. S. East, A.R.I.B.A.*)

Since the war, educational progress has been very rapid, and the Governments of the various colonies, together with the school authorities, have been equally zealous both in improving and enlarging existing school buildings and promoting new schemes. Consequently, in the last few years many excellent buildings of various types have already been erected, and a large number are either in course of erection or projected.

It is scarcely necessary in a work of this kind to explain or consider the educational systems in force in the various colonies, but a word or two is necessary to explain how the architectural portion of the work is carried on. In Cape Colony the school buildings are almost universally designed and supervised by architects appointed direct by the Committee or School Board of the district or districts. The plans thereof are submitted in sketch form to the Education and Public Works Departments of the colony, amended if necessary, and then provisionally approved. Working drawings and specifications are then prepared by the architects or architect, and again submitted for final approval.

In the Transvaal and Orange River Colony the plans for the various schools are prepared by the respective Government architects or under their instructions, and are tendered for and carried out under departmental supervision in the usual way. In the case, however, of the more important schools and higher educational buildings in all the colonies, competitions on the usual lines are generally instituted.

School planning generally in South Africa differs principally from the British types in two important particulars, namely, that artificial heating is rarely a necessity and consequently seldom provided for, and that efficient ventilation and protection from sun, wind, and dust are of primary importance, and require most careful thought and treatment.

A type of school very much favoured, especially in Cape Colony, is one planned on the quadrangular system (an example is given on a later page), in which the various classrooms, etc., are arranged round an open quadrangle, with a broad stoep or covered colonnaded verandah all round it, giving access to the various rooms.

In a climate where the rainfall is limited to perhaps thirty or forty school-days during the year the quadrangular system has many advantages, amongst which may be enumerated the following :—

(*a*) Natural cross ventilation to the various rooms, etc.

(*b*) Efficient observation of scholars by the teachers in charge.

(*c*) The provision of a space sheltered from wind and dust (a most necessary adjunct to a school in this climate), in which the stoep serves for a substitute for the covered playground of the British school.

(*d*) An excellent drilling and exercising ground.

The quadrangular plan is considered most suitable for one-storeyed schools, with provision for from three to four hundred pupils, but there seems no reason why the principle should not be applied to two-storeyed schools accommodating double the number.

The school hall type is, however, not altogether discarded, many examples having been and still being erected. These vary little from the accepted type in use in other countries except in matters of detail.

In the Orange River Colony a somewhat novel arrangement is in general use, corridors and quadrangles being alike avoided, the various classrooms being connected by verandahs, and a separate cloak-room and lobby provided for each. The cloak-rooms are so arranged as to be under the direct supervision of the teacher in charge of the class.

Classrooms. — Here, as elsewhere, classrooms, their size, aspect, shape, lighting, and ventilation, are the most important feature of the school plan, and as scholars naturally spend most of their school time in them, too much attention cannot be paid to their arrangement and details.

Classrooms accommodating at the most fifty scholars and down to thirty have proved to be the most satisfactory both from the teaching and hygienic point of view, the mean of forty being perhaps the most useful. At least 17 square feet of floor space per pupil and about 220 cubic feet of air space is necessary, and, where finances permit, it is advisable to allow an even larger amount.

All classrooms should face either east or north-east for preference, as the admission of the morning sun only is desirable. Classrooms facing north, however, can be rendered almost as effective by the careful use of hoods over the windows. The western sun should

invariably be excluded, and if classrooms facing west or north-west are unavoidable, louvred shutters must in all cases be fixed to the windows. Science and other rooms in occasional use are best arranged facing south.

The light must, of course, invariably come from the left side of the scholars, and it is better, even where architectural appearances seem to demand it, that no back lighting be allowed. Window sills should be about 4 feet from floor, the lower panes being glazed with obscured glass. To avoid shadows, piers between windows should be as small as possible consistent with strength. Owing to the clear atmosphere and powerful light, an allowance of about 15 per cent. of floor space in glass is sufficient, as more light than this causes a glare and is injurious to the eyesight of the scholars.

Where classrooms are arranged round the quadrangle the cross currents between doors and windows are a great aid to natural ventilation. In corridor planned schools pierced gratings are usually inserted in the walls between classrooms and corridors, to gain as far as possible the same result. The usual inlet flues and ventilators are generally provided, together with ceiling outlets and ducts finishing in turrets with Boyle's or other patent extract cowls.

Classrooms are usually from 13 to 14 feet in height, the windows mostly of the double-hung sash type, with pivot-hung fanlight over, the window heads being kept as near to ceiling level as possible.

Blackboards are desired on two sides of classrooms at least, at the usual height, and each classroom is fitted with book cupboards besides the usual desks (mostly on the dual system).

Cloak-Rooms.—Owing to the somewhat scanty rainfall and the consequent disuse to a great extent of overcoats, cloaks, etc., cloak-room accommodation is not considered of vital importance. The arrangements are often not as well thought out as they should be, and sufficient space not always provided.

Latrines.—In large towns and others where there is plenty of water and a drainage system is available the usual type of latrine with flushing cistern, etc., is of course in use, and where water only is laid on a septic tank drainage system is occasionally installed. In most country schools, however, earth closets are the only type in use.

Where water is very scarce the roof water is usually conserved in a large circular tank, and used for lavatory purposes.

The following illustrations of schools, although not entirely representative or sufficient, will give some idea of the prevailing styles and types.

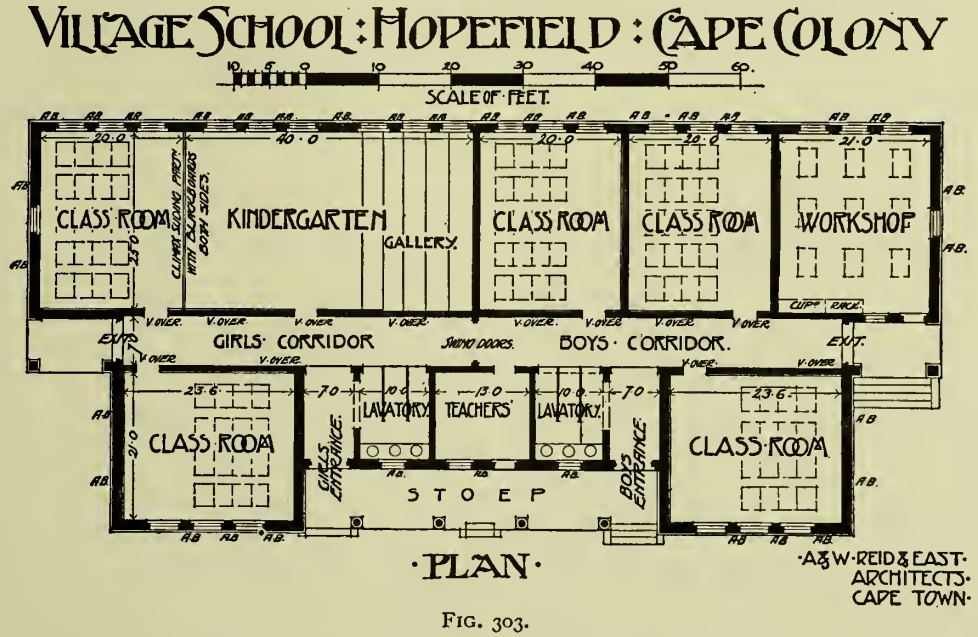


FIG. 303.

The school at Hopefield, Cape Colony (Fig. 303), designed by Messrs. A. & W. Reid & East, is a very fair example of the ordinary village school, and accommodates about 230 scholars in the class and kindergarten-rooms. It is intended to serve a rather wide district, and the completed scheme provides for boys and girls boarding departments in separate houses, each intended to house 28 boarders.

The building is arranged on the corridor system, with separate entrances and exits and corridors for both sexes, and, while extremely simple and plain in arrangement, is a very workable and convenient plan for a school of this type. Airbricks (A B) are shown in the outer walls.

The High School (Fig. 304), by the same architects, has been planned for an important country town and educational centre in Cape Colony. It is representative of the latest ideas regarding the quadrangular one-

storey school system, and may be looked upon as more or less a model plan of the type. The quadrangle is very spacious, and the entrances at the four corners are contrived so as to avoid the collection of stagnant air at those points—this being the principal difficulty to overcome in quadrangle planning. When the whole of the building is completed the classrooms will hold about 400 boys.

Separate entrances and cloak-room accommodation have been arranged for junior and senior boys, and

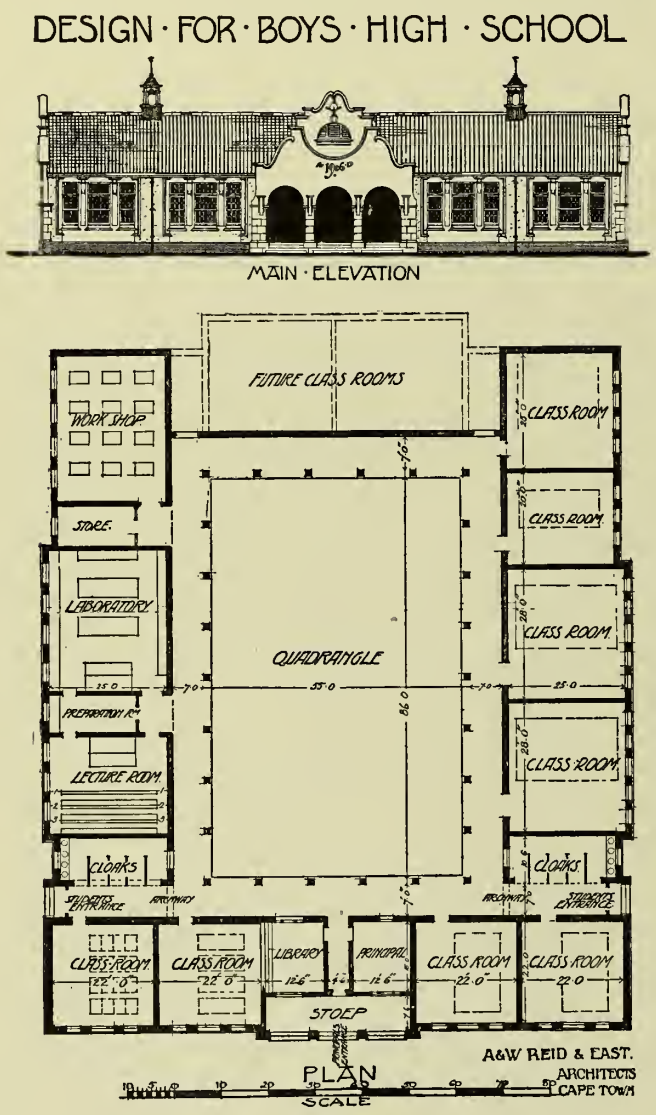


Fig. 304.

the headmaster's room and school library are planned in the centre of the front, so as to command as far as possible the whole of the school, and to be readily accessible to parents without interruption to the school work.

The exterior has been kept very plain and simple for economical reasons, the elevations being treated in rough-cast and plaster on a red brick foundation, and the roofs covered with Marseilles tiles. The colonnaded stoep round the quadrangle has a corrugated iron roof supported by red brick piers with bull-nosed angles.

The classrooms proper all face north and east, the laboratory, lecture-room, and workshop having a south light. The future extensions must of necessity face the west.

Fig. 305.

Fig. 305 shows one of the many Stellenbosch schools, and has been arranged as a Girls' High School. It has been designed by Messrs. Parker & Forsyth.

It is a good example of classrooms, etc., arranged round a central hall, and the entrances and cloak-rooms are very satisfactory. As it is connected with a large boarding establishment an entrance has been planned leading from the grounds thereof.

The buildings are more substantially built than is

usual for up-country schools, the walls being faced with red bricks and the roofs covered with slates, the whole forming a picturesque and satisfactory composition.

As the South African College, Cape Town, has grown from small beginnings, and been enlarged many times during its existence, the buildings generally are arranged in blocks, with or without connecting corridors as considered necessary. Fig. 306 shows the laboratory buildings, designed by Messrs. Baker & Massey, in which are arranged, on up-to-date scientific principles, the zoological, geological, and botanical laboratories. The plan is rectangular, the rooms being grouped round a central hall. The building, although plainly treated externally, is extremely well fitted internally, all the fittings being prepared locally from the architect's own designs and details. The exterior walls are faced with grey-veined Queenstown stone, and covered with a red English tiled roof. Both the

THE·LABORATORY·BLOCK·SOUTH·AFRICAN·COLLEGE·CAPE·TOWN

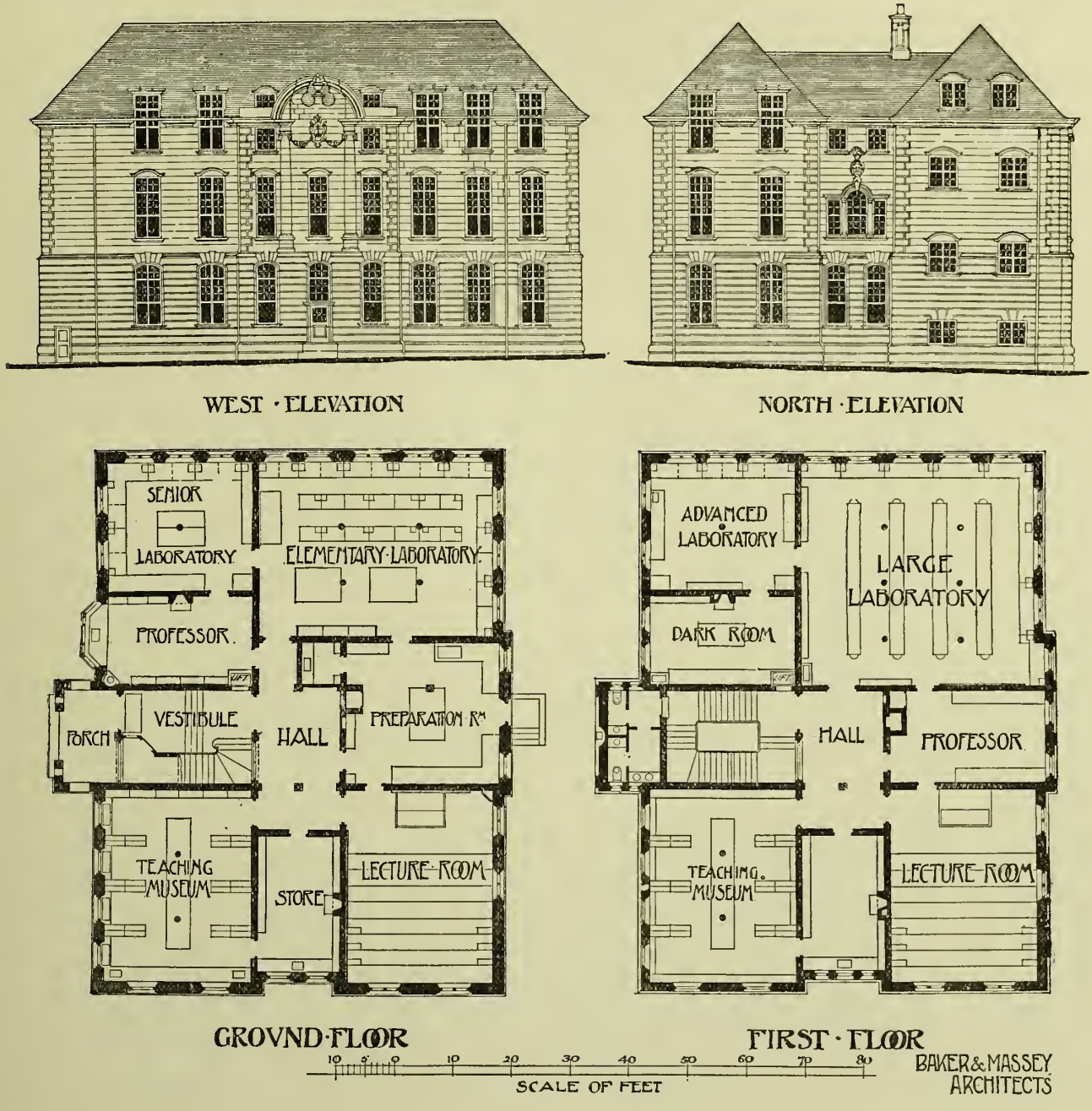


Fig. 306.

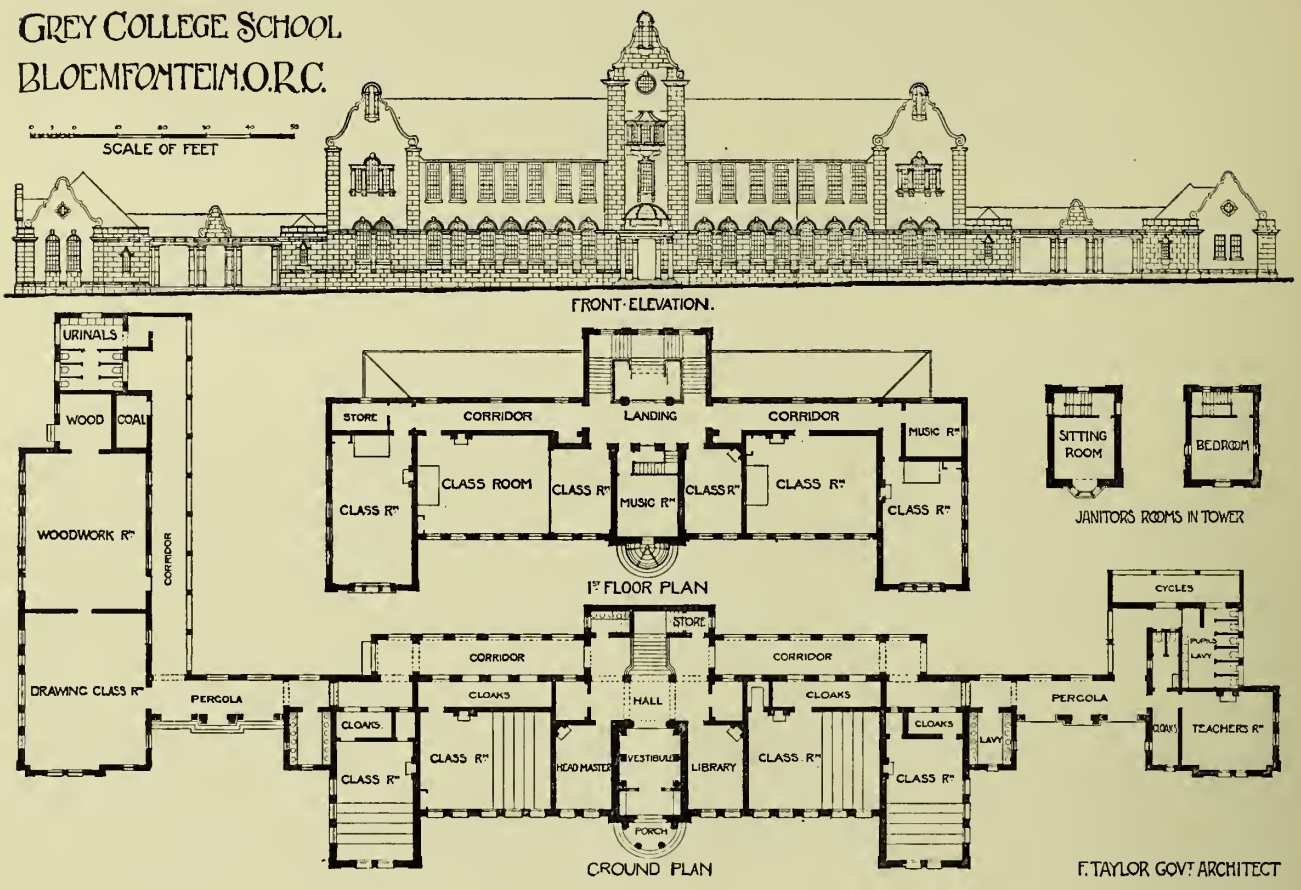


FIG. 307.

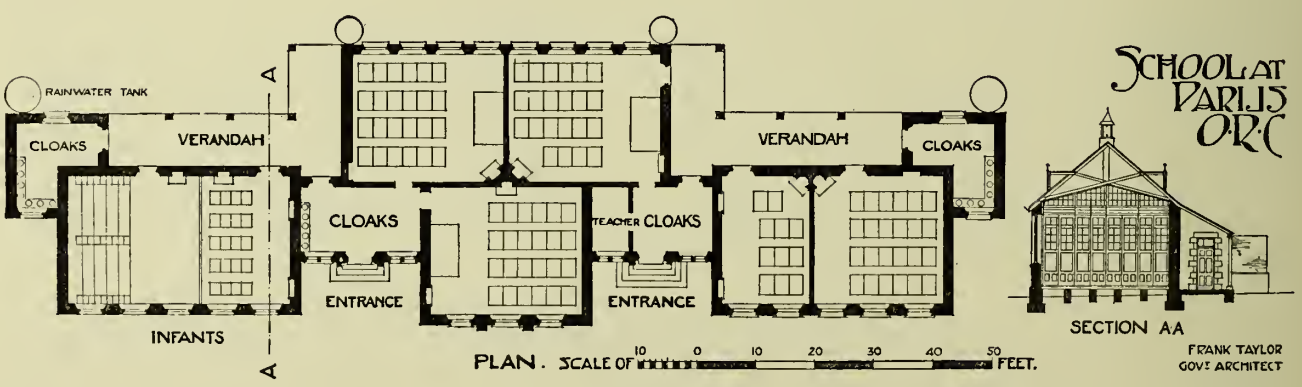


FIG. 308.

external and internal joinery and fittings are executed in teak.

Fig. 307 illustrates Grey College School, Bloemfontein, which is the most important school in the Orange River Colony, carried out under Government auspices. It well illustrates the varying views of the different educational authorities, and is, of course, the direct outcome of their veiws of the climatic and other needs of that colony.

The arrangements are well worth study, on account of the several local peculiarities displayed in the plan.

As the winters are somewhat severe round Bloemfontein, open fireplaces are provided in the class and other rooms. The principal front faces south, as it is not considered desirable in this case that much sunlight should be admitted to the various classrooms. Supervision of the scholars is to some extent sacrificed to free-air disconnection of departments almost on hospital lines.

The elevations are treated in freestone and plaster, and the roofs covered with red tiles. Mr. F. Taylor is the architect.

The school at Parijs, also the work of Mr. Taylor (Fig. 308), is a typical small country school in the same colony, such as is used in many districts where the same amount of accommodation is required, being varied only in detail. It will be noticed that a covered verandah or stoep replaces the English corridor for purposes of communication.

As most of the larger country schools have boarding houses or establishments connected with them, in order to cope with the difficulties of educating a sparse and scattered population, an illustration (Fig. 309) is included of a boarding-house in connection with the Boys' High School at Worcester, Cape Colony. It shows more or less the usual requirements of the Education Department both as regards dormitories, dining-hall, study, and matron or manager's apartments. As it has been designed to accommodate boys, a changing-room is included, which is, of course, omitted in buildings of a similar character intended for girls.

It is meant to accommodate forty boys, and, as is almost universal in buildings of this nature, economy both of planning and construction is the main consideration in the eyes of the authorities. The planning is exceedingly direct and simple, the kitchen service being particularly well contrived.

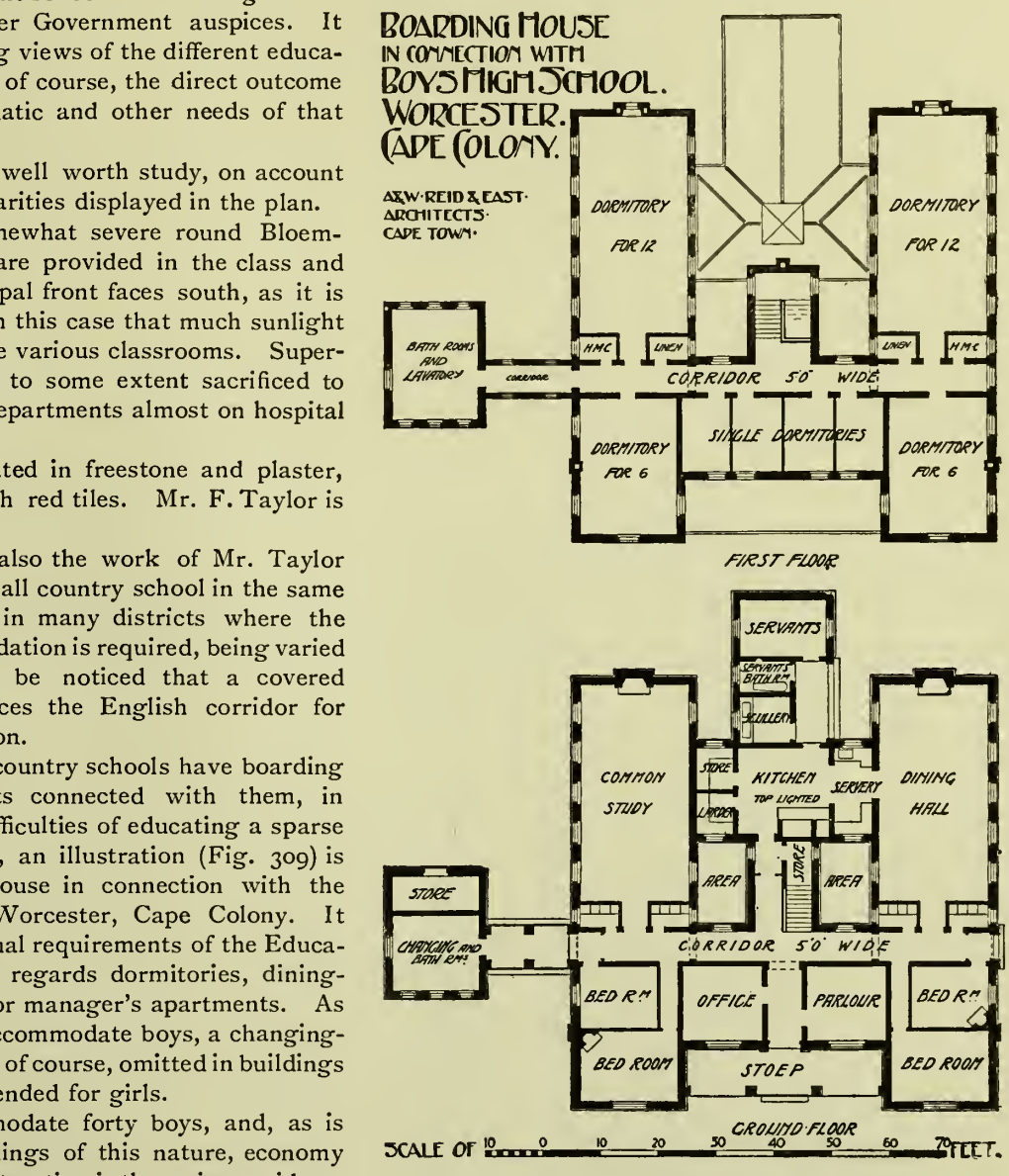


Fig. 309.

CHAPTER IV

ECCLESIASTICAL AND PUBLIC BUILDINGS

Ecclesiastical Buildings

(Contributed by H. S. East, A.R.I.B.A.)

Some brief consideration of the various other buildings common to South Africa, as well as most other countries, is necessary, although many of the differences in planning, methods of construction, and the use of materials noted in the foregoing chapters apply equally to

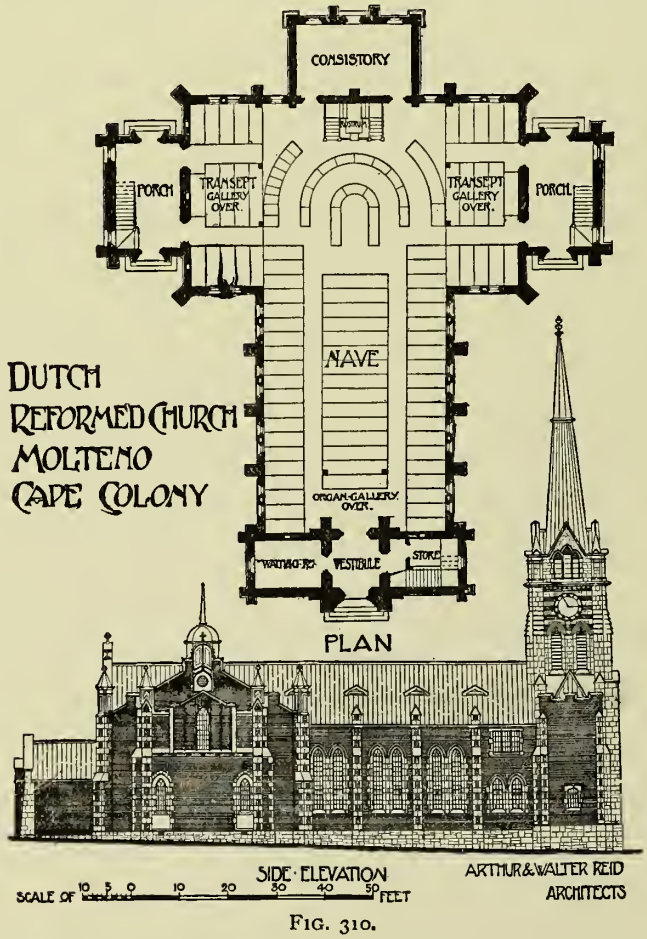


Fig. 310.

buildings of all kinds, whether of a private, semi-private, or public character.

Considering ecclesiastical work first, it can hardly be said that church buildings as a whole reach the same artistic level as the modern houses and buildings of a more or less private nature.

The many Dutch churches scattered over all the colonies are usually of large size in proportion to the towns or townships in which they are situated, owing to the fact that at certain times they are required to accommodate the farming community for a wide area, as well as the people in the immediate neighbourhood. These churches, including those built within the last decade, are as a rule deplorably deficient in architectural quality, and often constructionally unsound, owing to the lack of suitable materials and efficient workmen. Generally designed in a debased Gothic style, instead of being the most interesting and beautiful of all the neighbouring buildings, and a dignified landmark for miles around, they are monumental in their ugliness.

Even the very few churches now existing, which were erected during the early days, have unfortunately little of the happy effect of the old farmhouses and other buildings of the same date.

No doubt, in course of time a suitable and characteristic style will be evolved, but progress in this seems very slow, and the immense possibilities both of suitable planning and picturesque appearance are but little appreciated and understood by the majority of local architects entrusted with church work. Most of the churches too, erected, or rather designed, by English or foreign architects, who lack experience of local peculiarities, climate, and materials, are elaborate without being in the least degree suitable or in harmony with their surroundings, besides being very costly. In fact, they are often more offensive failures to the trained eye than are the creations of local ignorance.

Broadly speaking, the primary needs of importance in church planning and design in this part of the globe are—firstly, the provision of ample shade and shelter from the sun rays; and secondly, plenty of ventilation and air space, with perhaps a larger allowance of floor area than is usual in colder countries.

To provide for the first of these, deeply recessed windows and broad overhanging eaves are necessary, and indeed often used, but a further and even more suitable provision might be made of open ambulatories round three sides of the church, thus completely shading all the lower windows and the entrances also,

as well as providing the opportunity for a peculiarly suitable architectural effect externally.

Were this ambulatory commonly adapted, the greater portion of each window beneath it could be made to open and thus efficiently aid the ventilation.

Fig. 310 illustrates a fairly typical church for the Dutch Reformed Community, in which the needs and requirements of that body as regards church services are well studied. It affords accommodation for about 700 worshippers in the body of the nave and galleries combined, and has been built with the floor sloping from the west end (or main entrance) to the rostrum.

Architecturally it is far in advance of the usual church, and has been erected at a cost approximately equal to that of a church of similar size in an English country district. It is built of good hard bricks with red facing (obtainable some miles from the site) and local stone dressings, except the mouldings, which had to be executed in cement. The roof unfortunately had to be covered with galvanised iron (Canadian pattern), owing to the expense of railway carriage of any better material.

Fig. 311 shows a small Wesleyan church at Kearsney, Natal, which has been designed by Messrs. Stott & Kirkby with considerable regard to climatic necessities, as evidenced by the widely projecting eaves and small recessed windows. The exterior and interior are both very simply and economically treated.

The Anglican Cathedral for Cape Town (Fig. 312), designed by Messrs. H. Baker & Massey, is undoubtedly the most important church building either contemplated or being erected in South Africa at present. It is to be built on the same site as the existing church, but with a different axis (the present cathedral, designed on Greek lines, faces north-west) which enables a considerable portion of the new church to be finished and ready for use before the old one is demolished.

The portion at present to be built is shown on the plan and elevation illustrated, and the foundations for the greater part of it are already completed.

The design is perhaps somewhat continental in type, and shows a very lofty pile with carefully thought-out light and shade, and window openings well proportioned and deeply recessed between projecting buttresses.

The completed cathedral will have a finely designed square tower facing St. George's Street and the harbour, and is so planned as to form a noble finish to this important street. The eastern cloisters will be attached to the cathedral grammar school already erected.

It is to be built in hard local mountain stone as far

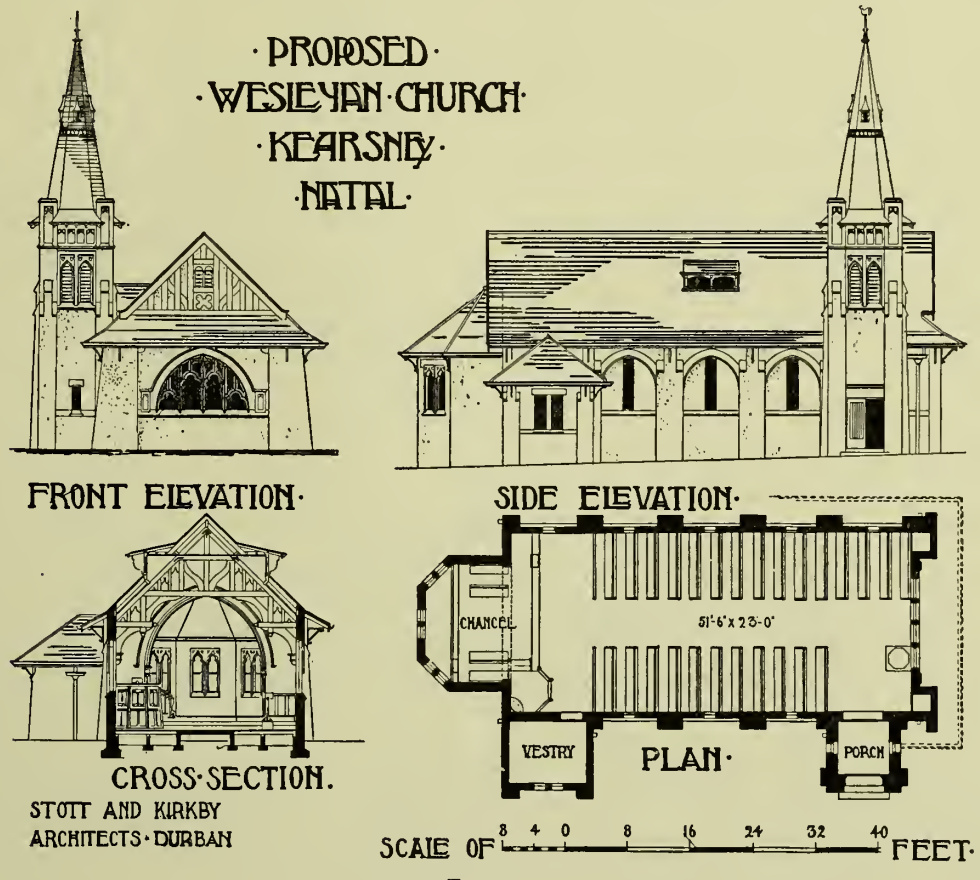
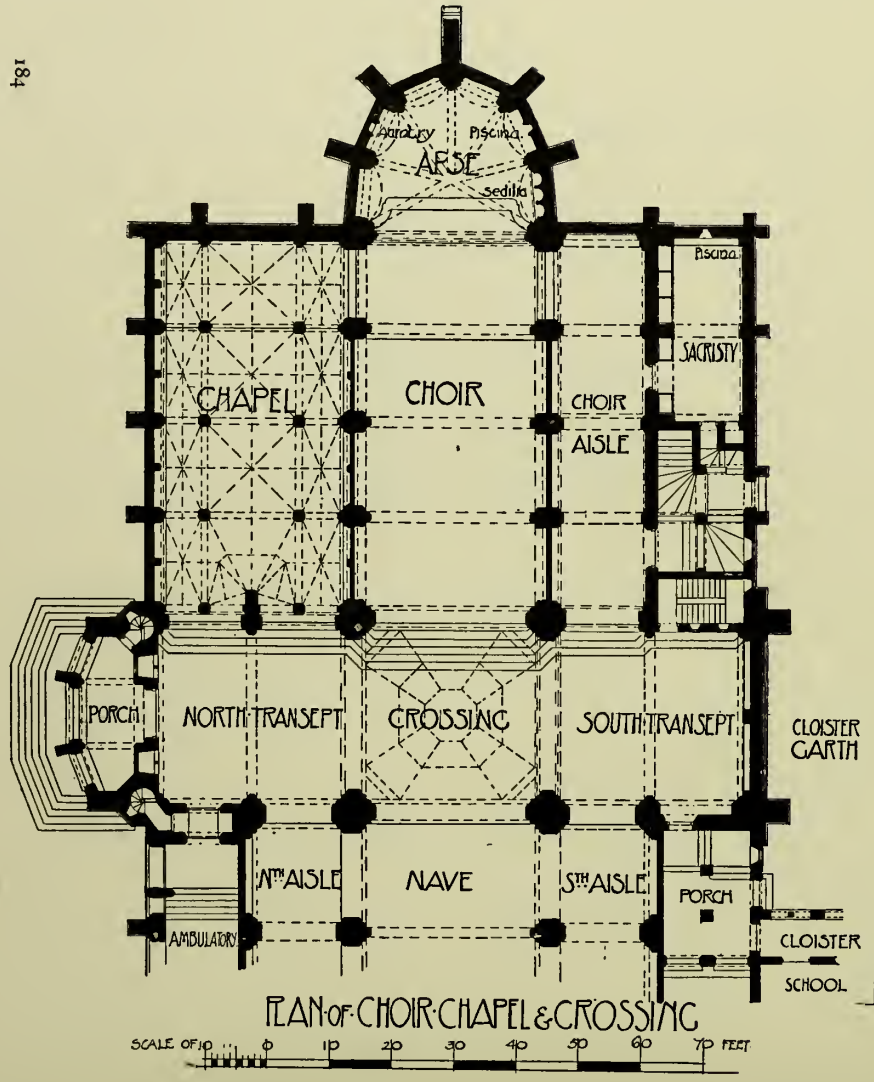


Fig. 311.


Aumbry
Piscina
APSE
Sedilia
Piscina
SACRISTY
CHAPEL
CHOIR
CHOIR AISLE
PORCH
NORTH TRANSEPT
CROSSING
SOUTH TRANSEPT
CLOISTER GARTH
NTH AISLE
NAVE
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AMBULATORY
CLOISTER
SCHOOL
PLAN OF CHOIR CHAPEL & CROSSING
SCALE OF 10 0 10 20 30 40 50 60 70 FEET

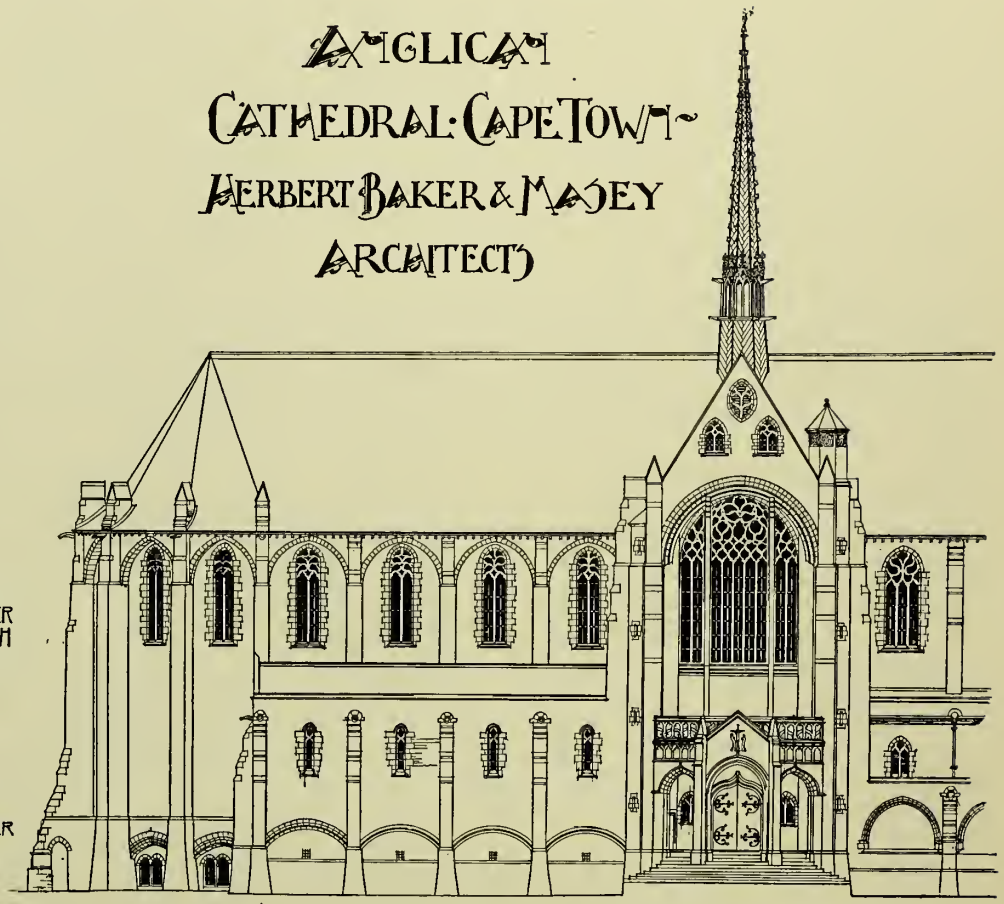
ANGLICAN
CATHEDRAL · CAPE TOWN ·
HERBERT BAKER & MASEY
ARCHITECTS
NORTH · ELEVATION

FIG. 312.

as possible, with freestone tracery and dressings where necessary.

Town Halls, Municipal Offices, etc.

The existing examples of municipal offices as a whole can hardly be considered to be particularly good, and generally speaking do not reach anything like the

Fig. 313.

standard of the provincial buildings of the same character in England.

There is little difference in the general planning and arrangement, as the ordinary requirments of municipal business are practically similar to those in English cities, with the exception that provision must be made for native pay and pass offices. These require to be more or less attached to the Treasurer's Department, but require separate entrances. Separate sanitary accommodation for natives is, too, usually required.

The Municipal Regulations with regard to hall exits, staircases, and fireproof construction are as stringent here as elsewhere, and their provision of the utmost importance. Crush spaces to halls and open loggias are, too, very necessary.

Cape Town has a town hall and municipal offices of considerable magnitude lately completed, but of little architectural merit or suitability; whilst Durban has an immense pile of buildings in course of erection, of both constructural and architectural interest.

Johannesburg, however, affords the opportunity of the future, and a competition is already mooted for a pile of buildings suitable for its present and future importance and population.

Hospitals and Sanatoria

Hospital buildings have scarcely up to the present received the attention they deserve and require, and there is great need in almost all the colonies for new and up-to-date buildings of this class.

In large towns, separate hospitals are required, and are usually built for whites and natives either in the same grounds or on different sites. In the smaller communities, however, the planning is complicated by having to provide for both classes as well as both sexes in each, with necessary sanitary accommodation for each and all.

In the case of small hospitals, the block plans given in Fig. 313 show, perhaps, the best way of solving the problem where this is necessary, by means of wards which radiate from a central administrative block.

It is advisable to provide large floor spaces per bed, and broad separate stoeps or verandahs, both for shade and for the use of convalescents. Ventilation, too, requires even more study and care than is necessary in most countries.

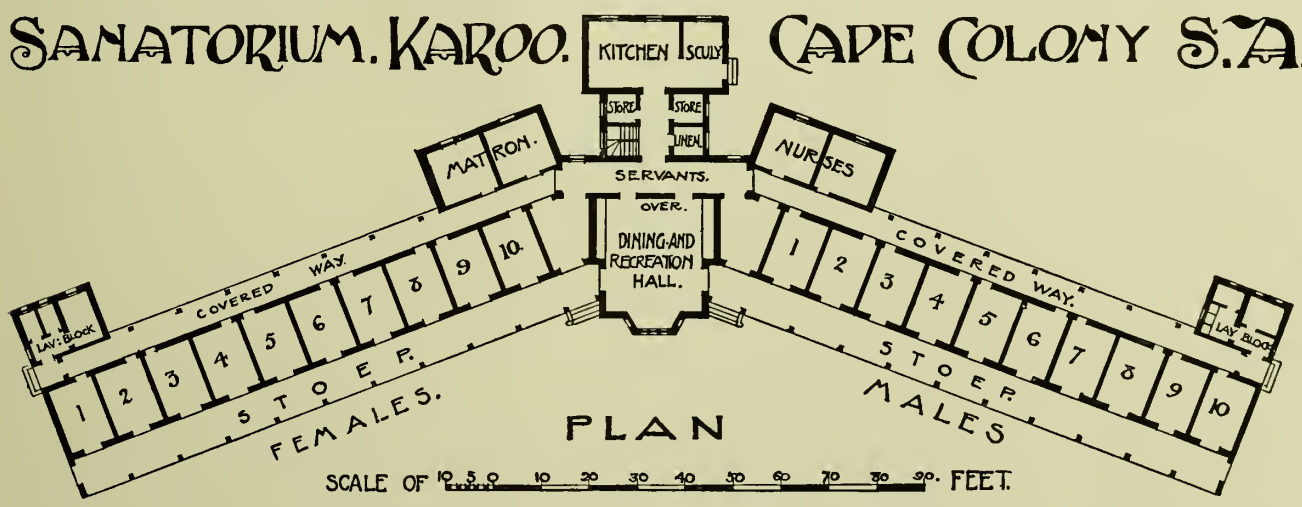

Fig. 314.

Owing to the many consumptives who have been and are making their home in South Africa, the question of suitable sanatoria for open-air treatment is receiving much attention, and before long, no doubt, several suitable and well-studied buildings will be erected. Fig. 314 shows a small sanatorium for consumptives proposed to be erected in a Karoo village (Cape Colony) as soon as funds are available. The plan is as simply arranged as possible in order to keep down the cost, and the probability of future extension has been kept in view.

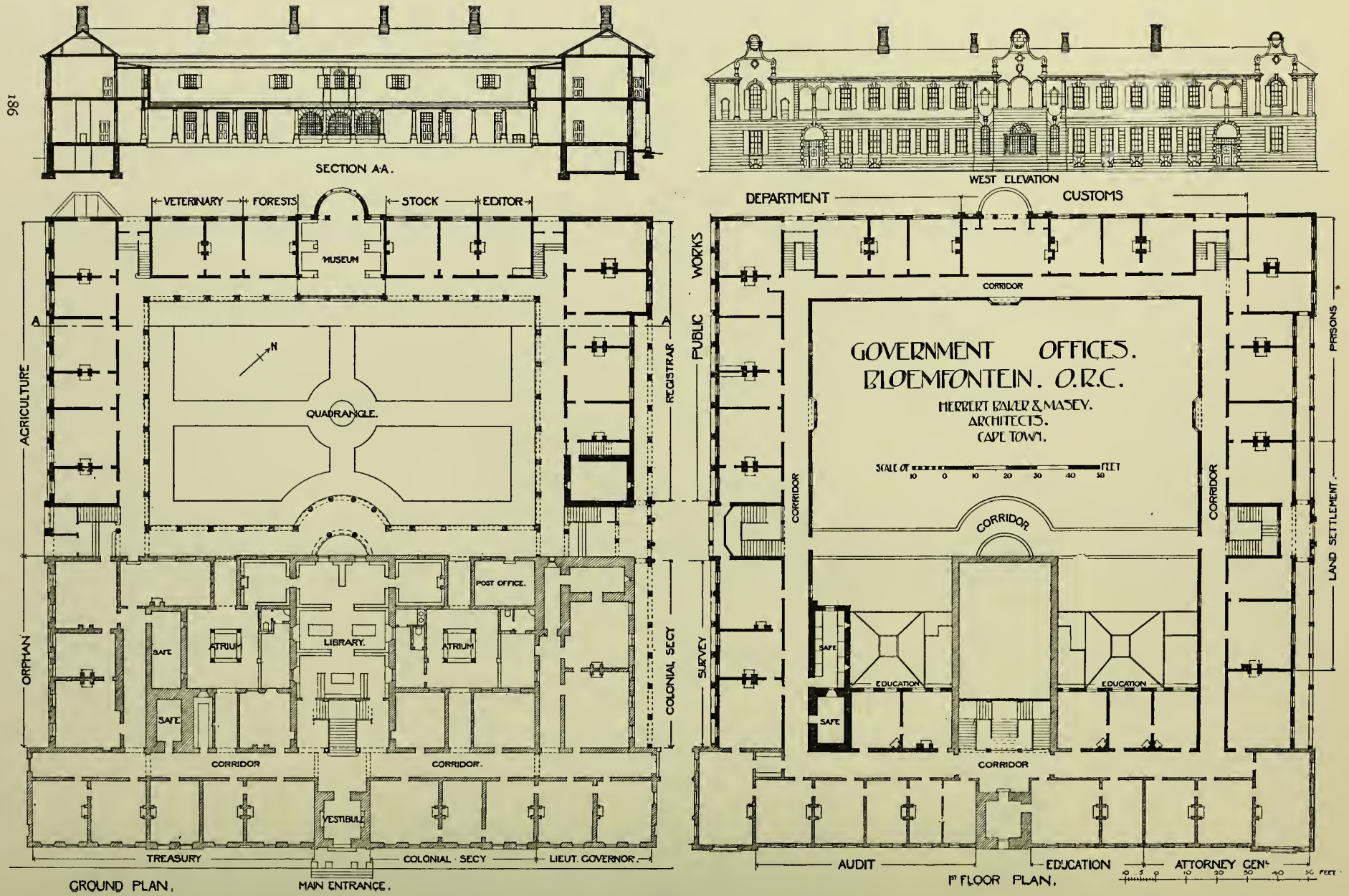
SECTION A·A.
WEST ELEVATION
GOVERNMENT OFFICES.
BLOEMFONTEIN. O.R.C.
HERBERT BAKER & MASEY.
ARCHITECTS.
CAPE TOWN.
SCALE OF FEET
VETERINARY
FORESTS
STOCK
EDITOR
MUSEUM
QUADRANGLE.
AGRICULTURE
REGISTRAR
PUBLIC WORKS
ORPHAN
COLONIAL SECY
SURVEY
LAND SETTLEMENT
PRISONS
POST OFFICE.
SAFE
ATRIUM
LIBRARY.
CORRIDOR
VESTIBULE
TREASURY
COLONIAL SECY
LIEUT. GOVERNOR.
MAIN ENTRANCE.
GROUND PLAN.
DEPARTMENT
CUSTOMS
EDUCATION
AUDIT
EDUCATION
ATTORNEY GEN.
1ST FLOOR PLAN.

FIG. 315.

Hotels

All the large towns possess hotels of considerable magnitude, often designed with considerable architectural attractiveness, and with well studied and suitable accommodation.

Fitted with awnings, it can be well used for tea and restaurant purposes.

Besides the ordinary hotel requirements, a winter garden with fountain is an additional attraction in large hotels, and in many instances a small suite of Turkish baths in the basement is added besides. The kitchen

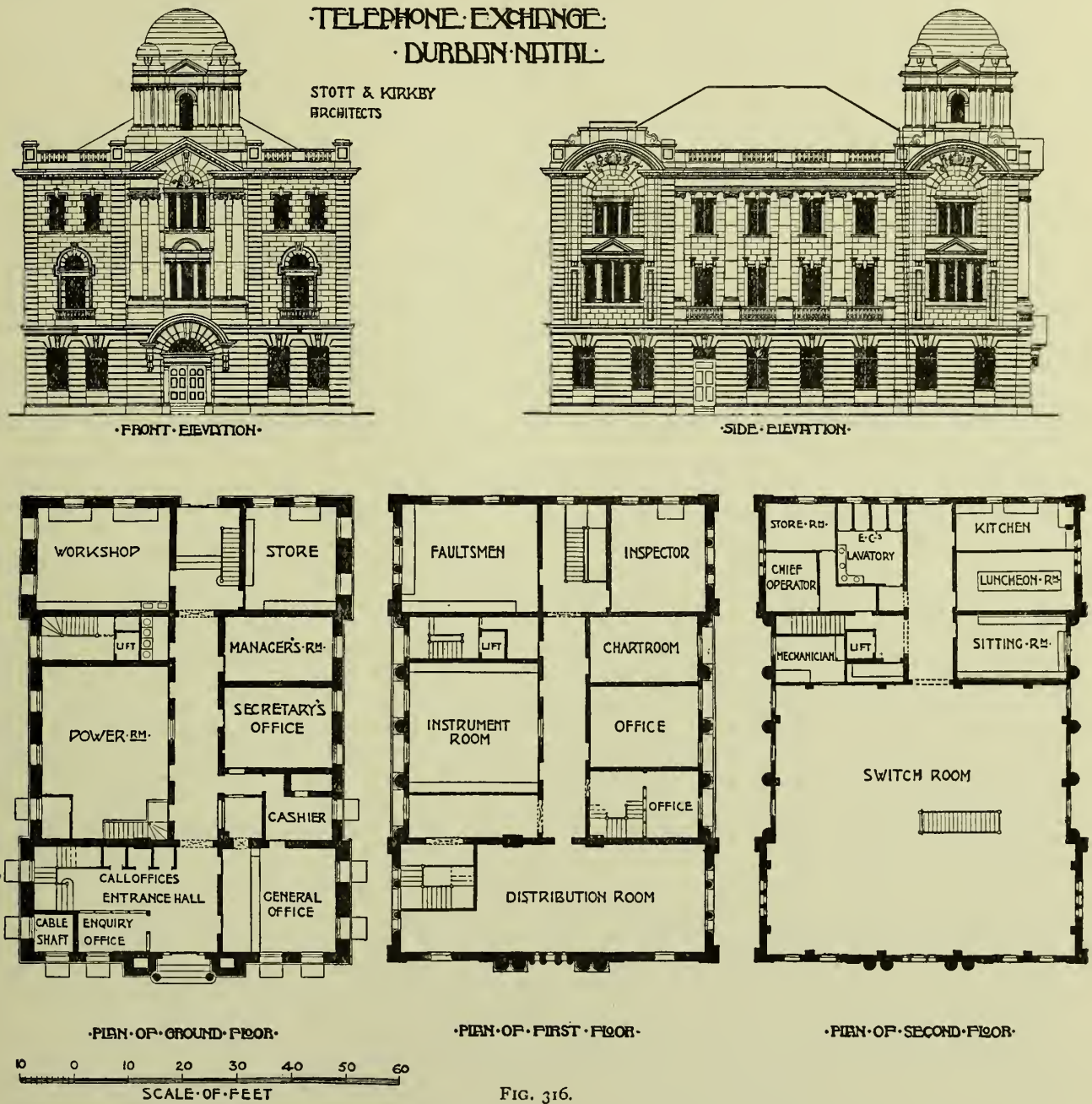

Fig. 316.

In hotel planning on an ordinary street site balconies are desirable to as many of the rooms which face the street or streets as possible. All internal rooms should be lighted by large and well-ventilated areas or courts, and a flat roof is an advantage, arranged with a suitable access to it by means of stairs and lifts. and service arrangements need planning with great care, the kitchens in most instances being best located on the top storey.

Government Buildings

South Africa contains no particularly notable legislative or parliamentary buildings at present. The

Parliament Houses in the various colonial capitals are generally designed in a somewhat debased Classic style, and are commonplace and unattractive, although fairly well planned as regards internal arrangements.

Both the Cape and Orange River Colonies — particularly the first named—contemplate building Law Courts of considerable magnitude. Although colonial law and legal procedure differ considerably from the grand jury room is necessary, as the grand jury system is not employed in any of the colonies, but the necessity of providing accommodation for coloured male and female witnesses, entirely separated from the remainder of the building, is often a source of great difficulty.

The Government Offices at Bloemfontein, illustrated in Fig. 315 by plans, elevation, and section, are fairly typical of the general arrangements of these buildings.

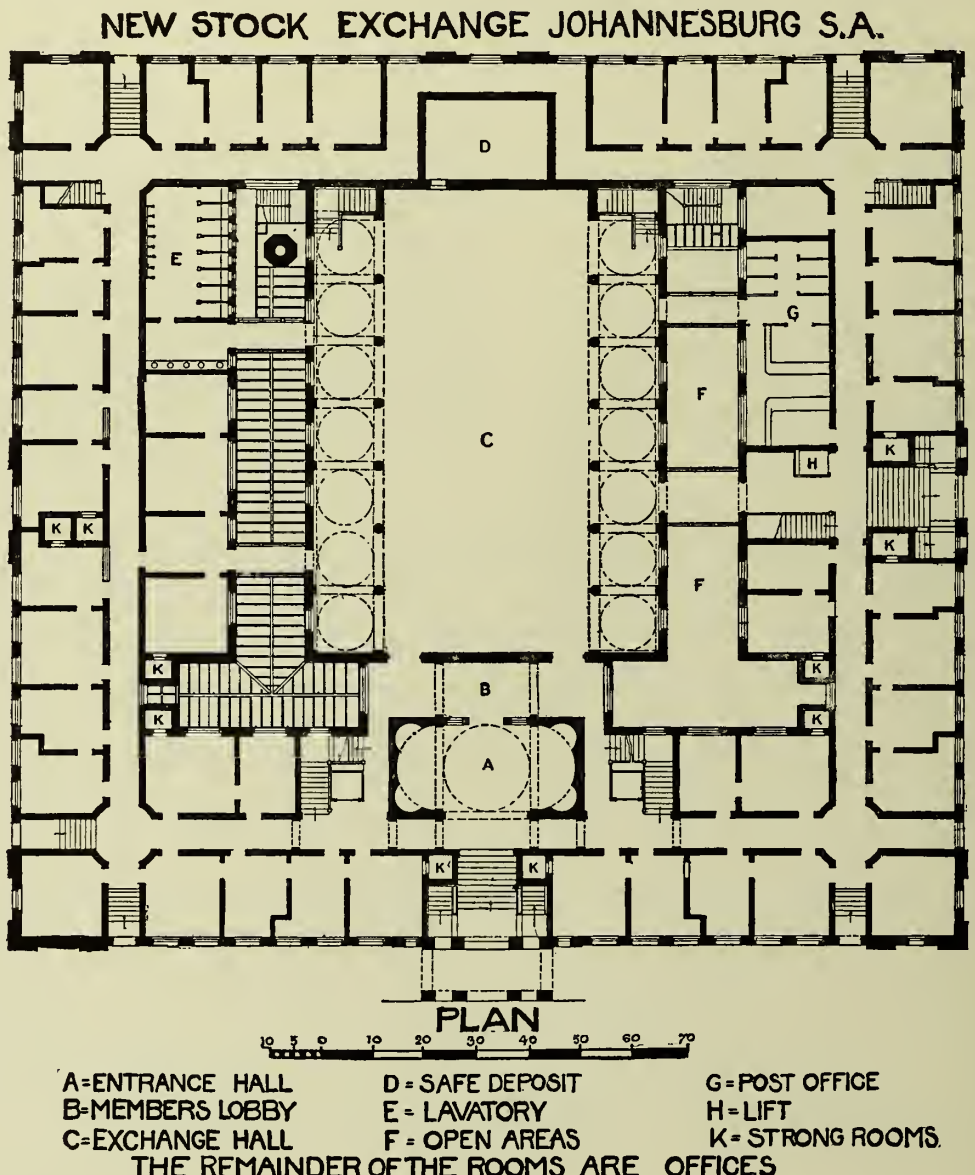

Fig. 317.

English, the planning of these buildings presents comparatively few distinctive features in their general arrangement.

Owing to the judges' chambers being often used for the hearing of applications, their position is of great importance in the general scheme. They are usually about 400 to 450 feet super., with a room about 180 feet super. adjoining, for the use of the judge's clerk. No

The portion of the building of which the walls are left in outline was erected in comparatively early days. The remainder has not long been completed from designs by Messrs. Baker & Massey, who, as several more departments required housing, were commissioned to re-model the old buildings and design the additions, shown in full black.

Climatic conditions were much studied, and as a result

THE STOCK EXCHANGE, JOHANNESBURG.

[Messrs. Leck & Emley, Architects.

the new buildings were grouped round a quadrangle, and have proved admirably adapted to departmental needs. Each of the new departments is approached from the corridor running round the quadrangle, and the various suites of rooms are connected by doors. The principal departments are placed in the older portion of the building, the central approach of which is still the main entrance. Subsidiary entrances are obtained on each of the other three fronts. The quadrangle is formally laid out and planted with orange trees, and it is intended to place a fountain in the centre at some future date.

The Old Dutch tradition is followed in the designing of the newer portions of the building, which has been carried out in brick and stone with red Marseilles tiled roof.

Fig. 316 shows the Telephone Exchange erected for the Durban Corporation, which has lately been completed, the design by Messrs. Stott & Kirkby having been selected in open competition. The plan is, of course, arranged to meet the peculiar requirements of an up-to-date telephonic system, yet it is open to several minor objections of cramped passages and rooms and an awkwardly arranged lift.

The whole building is as far as possible of fire-resisting construction, the floors being of concrete and steel, covered with either teak blocks or glazed imported tiles.

The entrance hall is laid in mosaic. A portion of the ground under has been excavated to contain the necessary fittings for the installation.

Fig. 317 and Plate VIII. illustrate the Johannesburg Stock Exchange, designed by Messrs. Leck & Emley, which is decidedly the most important building of its kind in South Africa, and indeed will bear comparison with similar buildings in any part of the world.

It is erected on a fine open site in the middle of Johannesburg, and contains about 225 offices, with lavatories on all floors. The offices, corridors, etc., are all heated by means of radiators.

The four elevations are treated in red brick with stone dressings in a free and yet scholarly Classic manner. Internally, the walls of the exchange hall are lined with marble, and have an ornamental tile dado. The columns are of scafiola with bronze bases and terra-cotta caps. The illustration of the interior (Plate VIII.) shows the exchange hall in process of construction, and is of considerable interest on account of the pendentives and domes thus nakedly displayed.

CHAPTER V

A SOUTH AFRICAN SPECIFICATION

(*Contributed by H. S. East, A.R.I.B.A.*)

The Specification as hereunder printed does not pretend in any way to be a model one, but a careful perusal of it will probably show more clearly than any other way the wide differences in the practical carrying out of work in South Africa and in any other country. It covers the usual local conditions, clauses, and methods of construction generally in use in Cape Colony for a house of the ordinary type.

SPECIFICATION of Work required to be done in the erection of a Villa Residence, Cape Town, South Africa.

Dimensions and Details.—Detail drawings are to be followed in preference to the small scale drawings, and figured dimensions to those obtained by scaling.

Tenders.—The proprietor does not bind himself to accept the lowest or any tender.

Time.—Builders when tendering must state the time within which they will undertake to complete the work under penalty.

Materials.—The builder is to provide all materials and plant that may be required for the due and proper completion of the work, whether the same is particularly described in this Specification or shown on the drawings or not, provided that they are to be reasonably inferred therefrom, and in case of any discrepancy between the Plans and Specification the Architects shall decide which is to be followed.

Safety of Work.—The whole work from the beginning to the completion is to be in the Contractor's charge, and he shall be responsible for damage to same from any cause whatever. The Contractor is to insure the building against fire from time to time for its full value, as the Architects may decide. The Contractor, however, is to see that the value of his work is fully covered at all times, and will have no claims against the Proprietor should fire occur.

Local Regulations.—The Contractor is to conform to all local regulations, give all notices and pay all fees, including . . . to be paid to the Architects for preparing and submitting special copies of the plans to the municipality.

Alterations in Plans.—The Proprietor shall have the right of increasing, decreasing, or altering the amount of work to be done as he shall think fit at any time, and should such alteration include a class of work not comprised in the Contractor's shedule of prices, the same shall be paid for at the Architect's valuation.

Setting out.—The Contractor shall be held responsible for the correct setting out of the work, and if errors occur they must be rectified as required by the Architects.

Sub-Contractors.—No portion of the work is to be sublet without the approval of the Architects.

Payments.—Payments will be made monthly at the rate of 80 per cent. of the value of the work done as per Architects' certificates. The remaining 20 per cent. will be paid in two instalments of 10 per cent., the first one month and the second three months after completion, provided that the work is in good order and to the Architects' satisfaction.

Surety.—If required the Contractor whose tender is accepted must find at any time an approved security for the due fulfilment of his contract.

Provisional Amounts.—It is to be understood that any provisional amounts named herein for goods or fittings to be supplied by the Builder are to be the values of such goods after deducting all trade and other discounts. The Builder is to add his profits when estimating.

Extras or Omissions.—A priced schedule is to be supplied to Architects by Builder before contract is signed, and such schedule will form the basis for adjustment of all claims for extras or omissions to or from the work comprised in the present scheme, fair allowance being made for fluctuations in the local market values of labour and materials as the Architects may decide. The Builder is to pay Architects the usual commission of $2\frac{1}{2}$ per cent. for the measurement and valuation of all works extras to or omitted from the contract, such commission to be charged by him in his final statement of account as usual.

Water.—Water provided for the completion of this work is to be provided by the Builder at his own cost. For pipes and fittings to service see "Plumber," with whom arrangements must be made about temporary standpipes.

The Contractor is to provide the necessary sanitary convenience for workmen, keep same in proper sanitary condition, and remove at completion. The Contractor is to clean up and remove all surplus earth (or spread same on site as directed), rubbish, etc., as it accumulates, and on completion to scour all floors, etc., clean all glass

on both sides, and leave the whole of the premises clean and fit for immediate occupation.

A competent Foreman is to be always on the works during their entire progress, and is not to be changed or removed without the consent of the Architects.

Contingencies.—Allow the sum of £ for contingencies, to be deducted at completion in whole or part if not used.

Excavator, Mason, and Bricklayer

Bricks.—The bricks are to be red hards, second quality throughout. Sample bricks are to be lodged with the Architects, and none of the bricks used are to be inferior in quality to those approved of.

Lime.—The lime is to be properly burnt stone or shell lime, or Belgian hydraulic as hereafter described

Sand.—Sand is to be approved clean and sharp, and well worked for plaster and cement rendering, and free from all vegetable and loamy matter.

Cement.—The cement is to be English Portland cement of an approved brand.

Excavator.—Excavate ground at back to extent shown, and for foundations under all walls, sleeper piers, drains, etc., and under all floors where necessary. Foundations to be stepped where shown on drawings.

No concrete is to be laid in trenches until the *whole of same* are excavated and passed by the Architects. Fill in and well ram round foundation walls when completed and passed, and level up ground where shown on drawings.

Concrete.—The footings under the whole of the walls are to be of concrete 3 feet wide under 14-inch walls, and 2 feet 3 inches wide under 9-inch walls, and 1 foot 9 inches wide under 4½-inch walls, and 12 inches deep; concrete to be composed of five parts broken metal (2⅛-inch gauge), three parts of clean sharp courses, and one part of Portland cement, mixed together with only sufficient water to bring same to a good consistency, thrown into trenches and well rammed.

The retaining walls to be of the thicknesses shown, and to be built right up in concrete as above, and to batter as on drawings.

Execute the foundation walls above footings to thicknesses, etc., shown in concrete as before specified, with all necessary boxing, planking, strutting, etc.

Damp Course.—Well flush up the foundations on top to a level surface in cement mortar 5 to 1, and lay on top a course of approved damp-proof sheeting, "B" quality, *the full thickness* of walls and wall-plates.

Brickwork.—Execute the brickwork generally with good sound bricks (no bats to be used) in English bond, perpends strictly kept, and no joints more than ⅜ inch thick, built in three of approved clay to one ot Saldanha Bay lime, or five of clay to one of Belgian hydraulic lime. No brickwork to be carried more than 5 feet above the rest of the work at any time, and all to be properly protected during wet weather.

Sleeper Piers.—Build sleeper piers in positions shown, including those carrying stoep floor, size 14 inches square, on 1 foot 6 inches by 1 foot 6 inches by 1 foot of concrete as before, in 6 to 1 cement mortar.

In Cement.—All brickwork and chimneys above roof, copings, oversailings, 4½ walls, and isolated piers to be built in 8 to 1 cement mortar.

Relieving Arches.—Turn relieving arches over all openings requiring same of two half-brick rings in 6 to 1 cement mortar.

Turn arches over all fireplaces on cambered iron bars 3 inches by ¼ inch turned up at ends.

Arches.—Turn shaped arches where shown on drawings on proper and sufficient centering, and strike centres when and as directed by the Architects.

Form trimmer arches to hearths of one half-brick ring in cement, or of concrete as for foundations.

Flues.—Carefully build all smoke flues of uniform dimensions throughout their entire length,—kitchen 14 by 9 inches, remainder 9 by 9 inches, jointed up smooth inside, and all bends as easy as possible. Carefully parge all flues with lime mortar as the work proceeds, and core out at completion and test same.

Ventilators.—Provide and fix under floors, in position to be settled by Architects, No. 14 galvanised iron 9 by 6-inch louvred ventilating gratings, and form proper flue ways to same. Provide and fix No. 12 in walls, and form proper openings to same. Provide and fix 3 ditto 12 by 9 inches as first in foundation walls under stoep in front.

Hoop Iron Bond.—Provide and build in 1¼-inch hoop iron bond to all brick walls, one line to each half-brick in thickness of walls, and at intervals of not more than 5 feet in height, well lapped and turned up and down at ends.

Form steps where shown in concrete as foundations, and to the sizes shown on drawings and such further details as may be given. Form walls at side in concrete or picked bricks.

Lay the floor of stoep and porch with 6-inch average cement concrete 5 : 2 : 1 on cambered 24 gauge corrugated galvanised iron sheets fixed on offset of foundations, and to 4½ by 3 inches R.S.J.'s where shown, and finished 1 inch in 3 to 1 cement, coloured red oxide in fine stuff in final layer, laid to fall, and form outlets in walls where required, brought out 3 inches from wall face as directed.

Thoroughly well ram and consolidate the surface under yard after excavation, and cover with 5 inches cement concrete as other, finished 1 inch thick in 3 to 1 cement, and all graded to gutters and to approval. Put similar concrete and filling in fender walls under hearths.

Templates.—Provide and fix under ends of rolled steel joists 12 by 12 by 6 inches and 9 by 9 by 6 inches concrete templates composed of 4 : 2 : 1, with two layers of felt on top as seating for joists.

Generally.—Perform all rough cutting, chases,

indents, oversailings, skewbacks, corbelling, etc., and execute all beam-filling necessary.

Cut and pin in, in cement, or build in as may be directed, the ends of all timbers, etc. Allow for fixing grates, tile hearths, etc., provided by proprietor.

Drainage.—The drainage to be laid in exact accordance with plan and particulars as approved by the municipal authorities, and in every respect to their satisfaction. Pipes to be best glazed stoneware with socketed joints ; each pipe to be straight, free from all cracks and flaws, and properly tested.

Excavate for drains, manhole, etc., to the various depths and falls necessary and shown, and properly and well ram and consolidate the bottom of trenches, and make good any soft places in concrete. After drains have been tested and passed, fill in to trenches and round pipes, and carefully and well ram so as not to injure the pipes.

Provide and fix approved trapped gulleys under sink, bath, and lavatory wastes, and form channel in cement to required lengths at foot of wastes. Channels to be formed in cement concrete, and gullies to be set in concrete.

Lay the various lengths of drains shown with 6-inch pipes between manhole and sewer as required, and 4-inch branches, with all necessary curved junctions, channels, etc., complete.

Provide and build where and as shown on plan the various manholes, size 2 feet by 1 foot 6 inches clear inside dimensions, and to the requisite depths, with 9-inch picked brick sides and ends in cement on a bed of 6-inch concrete as before, benched up around the half-round stoneware channels and connections. Render the sides with Portland cement trowelled smooth, and finish on top with approved galvanised iron manhole cover with keys, fitted into brickwork in cement.

Fix to the nearest manhole to sewer an approved brown salt-glazed intercepting trap bedded in cement, and connect from same to the sewer in street.

Where and as shown to this manhole fix a 4-inch galvanised ventilating pipe finished on top with mica flap valve.

The drains are to be tested in the presence of the Architect, and to his entire satisfaction, and to that of the Municipal Engineer.

Lay the open channel drains for rain water when and as shown in brick in cement cemented on top in 3 to 1 do., and to the lengths shown on drainage plan, on cement concrete as to foundations, overall size 16 inches.

Dig pits at ends of two of these channels, size 2 feet 6 inches by 2 feet 6 inches by 6 feet deep, built in rough brickwork, and fill in with loose stone, and cover with galvanised iron sheets and 18 inches earth on top.

Plasterer

Externally.—Those portions of the external walls not tinted on elevations to be finished in one coat of three to one cement at least $\frac{3}{4}$ inch thick. The walls of yard and outbuildings to be finished in 4 to 1 cement as before, one-coat work. All reveals to be finished in 2 to 1 cement.

The remainder of the walls tinted yellow to be finished in rough-cast in cement, and finish on 3 to 1 cement rendering $\frac{3}{4}$ inch thick.

The spaces between half timber of gable to be plastered in cement 3 to 1 with hair mixed in same on two thicknesses of approved wire lathing.

All mouldings, copings, brick columns, chimney caps, sills, caps, panels, piers, etc., to be finished in two-coat work ; other work 3 to 1 and 2 to 1 cement, all to details to be supplied.

Internally.—The walls of dining-room, drawing-room, hall, passages, and best bedroom to be plastered in two-coat work finished in putty or plaster as hereunder.

All other walls throughout internally to be plastered with best one-coat 2 to 1 lime and sand, strengthened with 1/10th cement, and trowelled to a fine smooth surface. All salient angles to be finished in 3 to 1 cement finely trowelled.

Provide and fix where shown on drawings plaster plate partitions $2\frac{1}{2}$ inches thick, to be supplied and fixed by the South African Fireproof Plate-Wall Syndicate Ltd., and allow for profit, use of scaffolding, plant, etc.

Provide to chimneys approved plain red chimney pots 15 inches high, set and flaunched up in cement.

Allow for 2 yards of white glazed tiles finished with small tiled bead as margin to sink in kitchen.

Form dado round bathroom 3 feet 6 inches high, and round kitchen 4 feet 3 inches high, in cement 3 to 1 on Portland cement 4 to 1 backing trowelled smooth, and finished with flush bead on top.

Slater

Cover all roofs, except to w.c. and woodshed in yard, with best approved Welsh countess slates with 2-inch cover, proper gauge and side lap, and properly secured to boarding with $1\frac{1}{2}$-inch composition nails, all to approval.

An alternative price to be given for covering roof in English tiles p.c. £4, 15s. per 1000, laid to $4\frac{1}{4}$-inch gauge, with all necessary plain ridge, hip, and valley tiles. In this case rafters to be 1-foot 6-inch centres and with $1\frac{3}{4}$ by $1\frac{1}{4}$-inch battens to proper gauge. Each tile to be nailed to battens with zinc nails, two to each tile.

Carpenter and Joiner

Timber.—All timber, unless otherwise specified, to be the best imported quality of red deal, free from sapwood, large or loose knots, shakes, and other defects, and all to be well seasoned. All timber in sight to be wrought. Roof timbers, floor joists, and plates to be Oregon, except joists and plates under ground floor, which are to be Jarrah or Karri.

All ceiling boards, cornices, architraves, and other

mouldings, etc., are to be well sand-papered before they are fixed, and all doors to be cleaned, cramped up, and glued where necessary.

Lintels, etc.—All lintels to be 3 inches thick, of the full widths, and with 6-inch wall-rest each end.

No timbers to come nearer than 9 inches to flues, and if necessary to be supported on wrought or cast-iron corbels.

Provide any necessary centering, etc., and remove same as and when directed, and provide all necessary fixing blocks, etc., for joinery.

Roofs.—Construct the roofs as shown on drawings, with 9 by 1½-inch ridges, hips, valleys, and gutter bearers; 4½ by 3-inch rafters not more than 30-inch centres, having 3 by 1½-inch tilting pieces to eaves where no stoep; 6 by 1½-inch ceiling joists or tie beams; 4½ by 3-inch plates, struts, uprights, and braces; and 9 by 3-inch bearers where and as shown. Truss over 4½-inch wall with 4½ by 3-inch head and sill, and 4½ by 1½-inch uprights at 3-feet 6-inch centres. All to be strongly framed together and braced as necessary. Cover roofs throughout with ⅞-inch G. & T. boarding.

Form all gutters and valleys with 1-inch boarding on proper and sufficient bearers firred up as necessary, and laid to proper falls.

The bearer over piers carrying verandah roof to be properly framed together and in deal.

Form flats where shown with 1½-inch bearers firred up as necessary to obtain proper falls, and covered with boarding as before, with all necessary rolls, drips, etc., as and where shown, and properly strutted.

Construct the roof over servants' w.c. and woodshed with 4½ by 3-inch purlins spaced as shown, and covered with 24 gauge galvanised iron, fixed with Roger's patent screws and washers.

Eaves.—Finish eaves of roofs with 6 by 1¼-inch eaves fascias, and small moulding under gutter and soffit with 12-inch projection in clear from 3 by 2 inch specially run moulding under to detail.

Finish eaves of lean-to roof (over w.c., etc.) with similar fascias, and side with 5 by 1-inch do., barge board with bevelled capping.

Barge Boards, etc.—Provide and fix to projecting gable moulded deal barge boards, with projecting moulding planted on, cut to fit the soffit of slates.

All the above roofs to be put together in the strongest possible manner, and well strapped to 4½ by 3-inch wall-plates. Wall-plates to be secured to walls by ⅝-inch bolts 2 feet 6 inches long, with anchor-plates at bottom every 5 feet apart, and upper wall-plate where necessary bolted to wall-plates with similar bolts, but shorter, or tied to same with stout hoop iron to approval.

Verandah.—The verandah roof is included in above.

Frame up the front gable in accordance with drawings on 11 by 3-inch bearer with 3 by 1-inch fillets on either side of same to take rafters and ceiling joists; 9 by 3-inch bearer to be taken out from brick wall of hall as shown and tenoned into the 11 by 3-inch bearer. Bolt these 9 and 3-inch bearers down to walls with bolts as for wall-plates. Studding to gable to be 4 by 1 inches, two to each half timber, and 4 by 3-inch raking pieces, all properly braced with 4 by 1½-inch interties and 3 by 1-inch diagonal bracing, as per detail to be supplied.

The half timberwork to gable to be in Jarrah or Karri, with 7 by 1½-inch uprights, 4 by 1½-inch raking pieces, and 10 by 1½-inch chamfered and diminished lower plates, all rebated for plaster.

Floors.—The ground floor joists to be of Oregon pine on 4½ by 3-inch Jarrah; wall and sleeper plates to be 9 by 3 inches to dining and drawing-rooms and hall, with two rows of herring-bone strutting between same in dining-room and drawing-room, and the remainder 4½ by 3 inches. All joists to be at 18-inch centres, and spiked to 4½ by 3-inch wall-plates.

Cover the floors throughout, except as already specified, with ⅞ red deal flooring, well cramped up and secured with two nails to each bearing on floor joists, with splayed heading joints, heads punched in, and all planed off smooth at completion. Trim for all hearths to approval.

Skirtings.—Provide and fix to all rooms, etc. 6 by ⅞ moulded skirtings to detail to be supplied,—p.c. 2d. per foot run. Kitchen to have small fillet to break-joint of dado and floor.

Ceilings.—Allow the sum of £20 p.c. for steel plate ceilings to dining and drawing-rooms, including cornices and fixing, and add for profit, scaffolding, and attendance.

Cover the remainder of the ceilings, including those of stoep, kitchen, pantry, and servants' room, throughout with ½-inch T. G. and double-beaded boarding, all well and closely laid and cramped up and finished to approval. The stoep ceiling to have beads to break-joint and angles and against plate and walls.

Trim for and form trap door in ceiling in position to be pointed out by Architects.

The ceiling of hall to have two 9 by 3-inch bearers with 2½-inch cut brackets under, and cornices mitred round and covered with scrim, fixed with copper and stout lining paper.

Picture Rail.—Provide and fix to hall, dining-room, drawing-room, and best bedroom 2 by 1½-inch stock pattern picture rail, at height shown on drawings, or as directed by Architects.

Provide and fix moulded cornice to detail 6-inch girth p.c. 2¾d. per foot run to all rooms except where there are steel ceilings, kitchen, and pantry.

Provide and fix to kitchen, servants' room, and pantry small scotia to break-joint of ceiling.

Doors.—The front entrance door to be in deal 2 inches thick; size, 6 feet 10 inches by 3 feet; upper panel prepared for glass as shown, and all in accordance with detail, having 1¾-inch fanlight hung to 4½ by

3-inch rebated and moulded frame, and sidelights with beads for fixing glass. Fix lock, etc., provided by proprietor. Provide and fix Preston's patent fanlight opener to fanlight, with all necessary cords, etc.

The double doors to stoep from dining and drawing-room to be similar in all respects, but 1¾-inch thick, and sashed with bars as shown, having fanlights 1¾ inch, with opener as before, all to detail. The doorway at end of hall opposite entrance door to be similar in all respects to front door, but with no sidelights.

The kitchen external door to be a stock sash door 6 feet 8 inches by 2 feet 8 inches by 1¾ inches, hung to frames, etc., as before, with similar fanlight and opener.

The internal doors throughout to be four-panelled stock doors, sizes as follow :—Dining and drawing-room doors, 6 feet 10 inches by 2 feet 10 inches by 1¾ inch ; bedrooms and kitchen, 6 feet 8 inches by 2 feet 8 inches by 1¾ inch ; bathroom, inside w.c., servants' room, and pantry, 6 feet 6 inches by 2 feet 6 inches by 1¾ inch. All to be hung to 1¼-inch framed jambs where in walls, and to solid, rounded, rebated, and grooved frames where there are plaster plate partitions.

Bathroom door to have fanlight over.

Note.—All doors facing hall and passages to be specially selected for staining. Fix all butts, locks, bolts, fastenings, locks, furniture, and finger-plates provided by Proprietor for these doors.

The w.c. door in yard to be 1¾-inch framed and braced batten door, hung in 4½ by 3-inch solid frame, size 6 feet 8 inches by 2 feet 8 inches. The door to cellar under stoep to be similar in all respects, but 5 feet 6 inches by 2 feet 8 inches.

Gates.—Form gates in wall to high-level road out of 2½-inch stuff, hung to 4½ by 3-inch rebated posts bolted to piers. Gate to be as detail, and to be provided with hinges, latches, etc., provided by Proprietor.

Windows. — Windows throughout, except where hereafter mentioned, to have deal-cased frames as follows, and 1¾-inch ovolo-moulded double-hung sashes, namely, 1¼-inch outside and 1-inch inside linings, 1½-inch pulley styles, and ½-inch back linings, with all necessary beads, parting slips, etc., complete, and all properly framed together, with 5 by 3-inch sunk, weathered, throated, and rebated teak sills. Upper sashes to be divided into panes as shown, with 1¼-inch bars moulded as sashes. All to be hung with best approved flax lines over approved brass faced axle pulleys, and fitted with sash fasteners and lifting rings to be provided by proprietor.

W.c. windows to be casement hung, 1⅛-inch sashes divided as shown, and hung to 4½ by 3-inch rebated and rounded frames, and head, with sill as before.

Butts, casement stays, and fasteners will be provided by proprietor.

Form borrowed light from kitchen to passage as above, but sash to be fixed outside, size 3 feet 6 inches by 2 feet 6 inches.

All windows as above requiring same to have ¾-inch linings, 1¼-moulded window boards with fillet under, and 3½ by ⅞-inch architrave to detail, p.c. 1¼d. per foot run, with all necessary mitres, returned ends, etc.

Door architraves to be similar to above, and outer moulding of architrave to mitre with skirting.

Form louvred ventilator where and of the size shown on front elevation, with 4½ by 3-inch frames and head, and 6 by 3-inch moulded, rebated, and throated teak sill, and ⅝ by 4-inch louvres spaced at 2-inch centres.

Provide and fix supports under sink, and form cupboard in same, with 3 by 1¼-inch square framing, and with plain ledged door with turnbuckle and knob. Draining board to be in teak, with sink opening cut out of solid, and grooved, etc., to architect's approval.

Provide and fix in pantry on strong and sufficient bearers and brackets three tiers of shelving, bottom tier 18 inches wide, one 12 inches, and two 9 inches.

Provide and fix to kitchen fireplace a mantelshelf 8 inches wide and 1½ inch thick on cut and shaped brackets and bearer against wall.

Provide and fix seats for two tanks of 9 by 3-inch deal bearers, ⅞-inch boarding, and 2-inch curb round same, in positions to be hereafter decided.

Fix wooden mantelpieces and grates and tile surroundings provided by Proprietor.

Form cupboard in best bedroom where shown, with pair of 1½-inch doors, moulded to match door on room side, and square finished inside. Doors to be hung to 4 by 3-inch frames, and with architrave as other doors, and finished on top with 2½ by 2-inch moulding as cornice, with returned end on one side and 1-inch boarded top behind on proper bearer.

Fix in cupboard one shelf, 12 inches wide, 15 inches from top, and under same a 6 by 1-inch chamfered peg rail. Fix lock, etc., and hooks to be provided by Proprietor.

Provide the sum of £5 p.c. for electric bells, and inlcude for profit and attendance.

Founder and Smith

Eaves Gutter.—Provide and fix to eaves, including verandah, 4½ by 3½-inch cast-iron moulded eaves gutter of approved section, with red lead joints, fixed to requisite falls to fascia, and with all necessary angles, junctions, outlets, and stopped ends.

Rain-Water Pipes.—Provide and fix where shown on roof plan 3-inch cast-iron heavy section rain-water pipe fixed to walls or to piers with all necessary swan necks, shoes, etc.

Provide and fix where shown on foundation plan and sections, 4 by 3-inch rolled steel joists, with ends cut and pinned to wall.

Anchors.—Provide wrought-iron anchors, one to each pin, to hold down verandah roof.

Chimney Bars.—Build in over chimney openings 3 by ¼-inch cambered and caulked chimney bars 2 feet longer than the opening.

Roof Bolts.—Provide the necessary roof anchor bolts specified in Carpenter.

Gasfitter

Pay fees and make connection with nearest main, and lay on gas to point in house hereafter decided, with ¾-inch galvanised-iron pipe. Excavate trench for same, and fill in and make good.

Fix meter where directed, and take ¾-inch wrought-iron gas tubing to centres to dining-room, drawing-room, and hall, and wall brackets in bedrooms, bath-room, and kitchen, with ½-inch branches to the various fittings.

Fix stop-cock and condensation pipe to clear pipes of water at lowest points in pipes.

Pipes to be jointed in red lead and tow with all necessary connections, diminishing pieces, T-pieces, heads, nozzles, etc.

Allow for attendance, etc., and make good and leave perfect at completion.

Plumber

All lead to be the best milled lead.

Flashings—Flashings and aprons throughout to be 4-lb lead flashings 6 inches and aprons 12 inches wide, neatly stepped as shown.

All flashings to be grooved into brickwork or under half timber and wedged. Make good the plastering to same.

Gutter.—The gutter and valley gutters to be 5-lb. lead, 18 inches wide and turned up at ends.

Cover the flats shown on roof plan and sections with 16 gauge Vielle Montague zinc, properly dressed over 1½-inch rolls, etc., as required, turned up under lead ridges at side and end, and all left water-tight and perfect.

The ridges to the flats over bedroom to be of 6-lb., lead to match galvanised-iron ridges in width, etc., properly secured to Architects approval, and dressed zinc over-work to flats.

To remaining ridges and hips, provide and fix to approval best stout galvanised-iron ridging.

Internally.—Lay on water from the main to the house with ¾-inch galvanised-iron pipe, and supply and fix as directed on bearers already specified No. 2 200-gallon tanks with approved ball-cock and valve complete, and overflow taken through wall. Provide and fix stop-cock on main where directed.

Cover the trays under cisterns with 4-lb. lead well turned up at edges, and take overflow from same through wall.

Take water from tank in ¾-inch galvanised-iron pipe as before to bath, lavatory basin, water-waste preventers, sink, and one point in yard and two points in garden, and provide and fix over sinks and to points in yard and garden approved brass screw-down taps.

Fix to w.c. in house and in yard w.c. apparatus with flushing cisterns, etc., complete, provided by Proprietor, and include for profit.

Fix sinks provided by Proprietor, and trap the outlet with 2-inch trap, and connect to drain.

Fix in bathroom bath and lavatory basin provided by Proprietor. Trap the outlets to bath with 2-inch, and to lavatory 1½-inch, as before, and connect to drain with enamelled-iron pipes, and continue same above roof as ventilator.

Provide and fix four cast-iron enamelled soil pipes with leaded joints connected to w.c. apparatus, and carried up as ventilators to height shown and required by sanitary authorities, and finished with wire-domed top.

Glazier and Painter

Glass.—Glaze the windows throughout except where otherwise described with 21-oz. sheet glass well sprigged, back puttied, and puttied in. The sash doors and fanlights to have 26-oz. sheet glass except as follows, and to be bedded in wash leather fixed with movable beads and brass cups and screws. Glaze the front door side and fan lights, door from hall to stoep and fanlight, and dining-room window with lead glazing p.c. 4s. 6d. per foot super.

Painter

Knot, prime, stop, and well rub down all wood usually painted, except as hereafter mentioned, and paint same three coats of good oil colour to tints to be selected by Architect. The woodwork of dining-room, hall, and passages, except ceilings, to be stained with approved water stains and twice varnished to Architect's approval. Twice distemper hall ceilings and frieze in cream colour to approval. All other ceilings, including steel ceilings and soffits of verandah, to be painted three coats finished flatted white. Paint all ironwork one coat oxide before fixing, and all exposed ironwork two coats oil colour after fixing.

The walls throughout internally to be papered p.c. 2s. 6d. per roll, with friezes to dining-room and best bedroom, p.c. 1s. 6d. per yard run.

Kitchen and servants' room and pantry to be three times distempered in Muralo to selected tints.

The cement dado in kitchen to be painted three coats to choice.

Externally.—Twice distemper all smooth plaster in limewash mixed with sea water.

Twice distempter all rough-cast in limewash as before, tinted with copperas.

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